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FOREWORD

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1.0 PURPOSE AND SCOPE OF THE GUIDE

The purpose of this Guide is to provide guidelines for the design of explosion-proof (XP) enclosures which will assure that the enclosure will both pass MSHA certification testing [1]* and fulfill its intended service life underground. The Guide covers only those aspects of design which affect the enclosure strength, ruggedness, and service life. It does not address electrical functions such as connector design, lighting, electrical leads, or electrical penetrations. An attempt has been made to keep the Guide general, rather than specific, so that it will continue to be useful as MSHA requirements evolve. Topics covered by this Guide are:

- o MSHA Design Requirements
- o Setting Internal Design Pressures
- o Design for Static Loads
- o Design for Dynamic Loads
- o Design for Ruggedness
- o Window and Lens Design
- o Thermal Stresses
- o Welded Connections
- o Bolted Connections
- o Reinforcement Around Openings
- o Materials of Construction

Example problems are given in the last section of the Guide to demonstrate its use.

*References are listed at the end of the report.

2.0 INTRODUCTION

2.1 Background

The concept for this design guide and much of the material contained herein originated in USBM Contract H0377052, "Analysis of Schedule 2G Enclosures," [2]. This contract included a survey of design and fabrication practice in the manufacturing of explosion-proof enclosures. The survey showed that a design guide could be useful to the mining industry to unify and formalize procedures already being followed and to introduce to the industry new data and procedures generated in Contract H0377052 and other related USBM research.

Tasks conducted under Contract H0377052 which contributed directly to this Guide were:

- Finite element analyses to determine stresses, strains, and deflections in the enclosures produced by internal static pressures
- Analyses to predict the response of enclosures to dynamic loading
- Hydrostatic testing of enclosures with measurements of strains, deflections, and strain patterns
- Comparisons between theoretical predictions and measured values
- A survey of Welding Procedures in the manufacture of Schedule 2G enclosures
- An evaluation of stresses produced by the Schedule 2G Impact Test and Thermal Shock Test for lenses
- An experimental study of the response of Schedule 2G enclosures to vibration
- A survey to determine ruggedness requirements for Schedule 2G enclosures in the mining environment
- Long-term aging tests on polycarbonate lens materials

In addition to the above tasks, information was taken from USBM Contract H0387009, "QA Standards for Bonding Materials Used in Explosion-Proof Enclosures," and from numerous other sources as cited in the reference list.

2.2 Organization and Use of the Guide

The Guide is organized to address the various steps in the design process in the approximate order in which they are usually made. It is divided into many chapters, each of which addresses a separate topic. It is hoped that, through this organization of material, the designer can easily locate and use the parts that he needs or follow through the entire design process.

When the Guide is first used, it is recommended that the designer review each chapter for content and then read carefully or work through the examples presented in the last chapter. The examples cover the procedures described in the Guide and will acquaint the designer with proper use of the equations, graphs, and tables.

A brief description of each topic (by Chapter) in the Guide follows:

Design Requirements: This chapter cites current MSHA requirements which affect the strength of XP enclosures and discusses new requirements that are now being considered for adoption by MSHA. MSHA requirements are subject to change, and current regulations must always be checked.

Design Pressures: This chapter gives procedures for choosing static and dynamic design pressures. The design procedure assumes that pressure piling does not occur, and guidelines are given which will help the designer avoid pressure piling in his enclosure.

Design for Static Loads: Procedures are given for sizing rectangular plates, circular plates, and cylinders to withstand the design static pressures without excessive distortions.

Design for Dynamic Loads: Procedures are given for treating the dynamic effects of explosive loading, while limiting permanent deformations in the enclosure to values which are acceptable by MSHA. Because of the limits on deformations imposed by MSHA during explosion testing, the dynamic pressure loads usually control the design (wall thickness, etc.) of the enclosure.

Design for Ruggedness: MSHA does not now have an explicitly stated ruggedness requirement; however, as noted in the Design Requirements, Chapter 3, a ruggedness test is being considered for adoption. This chapter contains procedures for designing the enclosure to withstand external impact loads which can occur in the mine and which will most likely be included in a ruggedness requirement.

Design of Windows and Lenses: This is an extensive chapter which covers the design of windows and their mounts for use in XP enclosures.

Thermal Stresses in Windows and Lenses: This brief chapter gives approximate procedures for evaluating thermal stresses which are produced in glass and polycarbonate windows and lenses by uniform heating of the enclosure.

Welded Connections: Weld joint design and joint efficiency are covered in this chapter. Material is taken primarily from AWS Welding Code DW14.4, and this code is referenced for welding procedures, welder qualification, and weld joint inspection.

Bolted Covers: This chapter contains design procedures for bolted connections, primarily enclosure covers. It seeks to avoid permanent deformations in the bolts (which could increase the flame gaps) and yet not overdesign the bolted connection. Cover restraint associated with external loads and prying action produced by internal loads are considered.

Reinforcement at Penetrations: Simple formulas for strength continuity are given for use in designing reinforcement around openings in the enclosure.

Materials for Fabrication: This chapter gives lists of materials which are suitable for XP enclosures. It includes metals, polycarbonates, glasses, sealants and adhesives, and gasket materials. Service life restrictions are noted where applicable, and procedures for qualifying new materials are included.

Examples: Examples which demonstrate the use of the material in the guide are included in the last Chapter. These examples do not cover the steps a designer must follow which lead up to the selection of an enclosure geometry, but they do address the design details which assure proper enclosure strength.

3.0 DESIGN REQUIREMENTS

As stated in the Purpose of the Design Guide, the requirements addressed here are those which affect the strength of the enclosure in its normal service underground. These requirements have been set forth in Schedule 2G [1] and in other correspondence from MSHA [3]. As now stated, these requirements are:

§ 18.23 Limitation of external surface temperatures.

The temperature of the external surfaces of mechanical or electrical components shall not exceed 150°C (302°F) under normal operating conditions.

§ 18.27 Gaskets.

A gasket(s) shall not be used between any two surfaces forming a flame-arresting path except as follows: (a) A gasket of lead, elastomer, or equivalent will be acceptable provided the gasket does not interfere with an acceptable metal-to-metal joint, (b) A lead gasket(s) or equivalent will be acceptable between glass and a hard metal to form all or a part of a flame-arresting path.

§ 18.30 Windows and Lenses.

(a) MSHA may waive testing of materials for windows or lenses except headlight lenses. When tested, material for windows or lenses shall meet the test requirements prescribed in § 18.66 and shall be sealed in place or provided with flange joints in accordance with § 18.31.

§ 18.31 Enclosures--joints and fastenings.

(a) Explosion-proof enclosures:

(1) Cast or welded enclosures shall be designed to withstand a minimum internal pressure of 150 pounds per square inch (gage). Castings shall be free from blowholes.

(2) Welded joints forming an enclosure shall have continuous gas-tight welds. All welds shall be made in accordance with American Welding Society standards.

(3) External rotating parts shall not be constructed of aluminum alloys containing more than 0.5 percent magnesium.

(4) MSHA reserves the right to require the applicant to conduct static pressure tests on each enclosure when MSHA determines that the particular design will not permit complete visual inspection or when the joint(s) forming an enclosure is welded on one side only (see § 18.67).

(5) Threaded covers shall be designed with Class 1 (coarse, loose fitting) threads. The flame-arresting path of threaded joints shall conform to the requirements of subparagraph (6) of this paragraph.

(6) Enclosures shall meet the following requirements (Table 3.1 in this Guide) based on the internal volumes of the empty enclosure.

Table 3.1. MSHA Requirements of Paragraph 18.31(6)

	Volume of empty enclosure		
	less than 45 cu. in.	45 to 124. in., inclusive	More than 124 cu. in.
Minimum thickness of material for walls	1/8"	3/16"	1/4"
Minimum thickness of material for flanges	1/4" ¹	3/8" ²	1/2" ²
Minimum thickness of material for cover	1/4" ¹	3/8" ²	1/2" ²
Minimum width of joint-all in one plane	1/2"	3/4"	1"
Maximum clearance-joint all in one plane	0.002"	0.003"	0.004"
Minimum width of joint, portions of which are in different planes-cylinders or equivalent.	3/16" ³	5/8" ³	3/4" ³
Maximum clearances-joint in two or more planes, cylinders or equivalent:			
(a) Portion perpendicular to plane	0.008" ⁴	0.008" ⁴	0.008" ⁴
(b) Plane portion	0.006"	0.006"	0.006"
Maximum bolt ⁵ spacing-joints all in one plane of 4 bolts	6" with minimum of 4 bolts	6" with minimum of 4 bolts	6"
Maximum bolt spacing-joints, portions of which are in different planes.	(⁶)	(⁶)	(⁶)
Minimum diameter of bolt (without regard to type of joint).	1/4"	1/4"	3/8"
Minimum thread engagement ⁷	1/4"	1/4"	3/8"
Maximum diametrical clearance between bolt body and unthreaded holes through which it passes. ⁸	1/64"	1/32"	1/16"
Minimum distance from interior of enclosure to the edge of a bolt hole.			
Joint-minimum width 1"			7/16"
Joint-less than 1" wide	1/8"	3/16"	

CYLINDRICAL JOINTS

Shafts centered by ball or roller bearings:

Minimum length of flame-arresting path	1/2"	3/4"	1"
Maximum radial clearance	0.010"	0.0125"	0.015"

Shafts through journal bearings:

Minimum length of flame-arresting path	1/2"	3/4"	1"
Maximum radial clearance	0.003"	0.004"	0.005"

Other than shafts:

Minimum length of flame-arresting path	1/2"	3/4"	1"
Maximum radial clearance	0.0015"	0.002"	0.003"

- 1/32-inch less is allowable for machining rolled plate.
- 1/16-inch less is allowable for machining rolled plate.
- If only two planes are involved, neither portion of a joint shall be less than 1/8-inch wide, unless the wider portion conforms to the same requirements as those for a joint that is all in one plane. If more than two planes are involved (as in labyrinths or tongue-and-groove joints) the combined lengths of those portions having prescribed clearances will be considered.
- The allowable diametrical clearance is 0.008 inch when the portion perpendicular to the plane portion is 1/4 inch or greater in length. If the perpendicular portion is more than 1/8 inch but less than 1/4 inch wide, the diametrical clearance shall not exceed 0.006 inch.
- Where the term "bolt" is used, it refers to a machine bolt or a cap screw, and for either of these studs may be substituted provided the studs bottom in blind holes, are completely welded in place, or the bottom of the hole is closed with a secured plug. Bolts shall be provided at all corners.
- Adequacy of bolt spacing will be judged on basis of size and configuration of the enclosure, strength of materials, and explosion test results.
- In general, minimum thread engagement shall be equal to or greater than the diameter of the bolt specified.
- Threaded holes for fastening bolts shall be machined to remove burrs or projections that affect planarity of a surface forming a flame-arresting path.
- Less than 7/16-inch (1/4-inch minimum) will be acceptable provided the diametrical clearance for fastening bolts does not exceed 1/32 inch.
- Shafts or operating rods through journal bearings shall be not less than 1/4-inch in diameter. The length of fit shall not be reduced when a pushbutton is depressed. Operating rods shall have a shoulder or head on the portion inside the enclosure. Essential parts riveted or bolted to the inside portion will be acceptable in lieu of a head or shoulder, but cotter pins and similar devices will not be acceptable.

§ 18.46 Headlights.

(a) Headlights shall be constructed as explosion-proof enclosures.

(b) Headlights shall be mounted to provide illumination where it will be most effective. They shall be protected from damage by guarding or location.

(c) Lenses for headlights shall be glass or other suitable material with physical characteristics equivalent to 1/2-inch thick tempered glass, such as "Pyrex." Lenses shall meet the requirements of the tests prescribed in § 18.66.

(d) Lenses permanently fixed in a ring with lead, epoxy, or equivalent will be acceptable provided only lens assemblies meeting the original manufacturer's specifications are used as replacements.

(e) If a single lead gasket is used, the contact surface of the opposite side of the lens shall be plane within a maximum deviation of 0.002 inch.

§ 18.62 Tests to determine explosion-proof characteristics.

(a) In testing for explosion-proof characteristics of an enclosure, it shall be filled and surrounded with various explosive mixtures of natural gas and air. The explosive mixture within the enclosure will be ignited electrically and the explosion pressure developed therefrom recorded. The point of ignition within the enclosure will be varied. Motor armatures and/or rotors will be stationary in some tests and revolving in others. Coal dust, produced by grinding coal from the Pittsburgh coal bed to a fineness of minus 100 mesh, will be added to the explosive gas-air mixtures in some tests. At MSHA's discretion dummies may be substituted for internal electrical components during some of the tests. Not less than 16 explosion tests shall be conducted; however, the nature of the enclosure and the results obtained during the tests will determine whether additional tests shall be made.

(b) Explosion tests of an enclosure shall not result in:

- (1) Discharge of flame.
- (2) Ignition of an explosive mixture surrounding the enclosure.
- (3) Development of after burning.
- (4) Rupture of any part of the enclosure or any panel or divider within the enclosure.
- (5) Permanent distortion of the enclosure exceeding 0.040 inch per linear foot.

(c) When a pressure exceeding 125 pounds per square inch (gage) is developed during explosion tests, MSHA reserves the right to reject an enclosure(s) unless (1) constructional changes are made that result in a reduction of pressure to 125 pounds per square inch (gage) or less, or (2) the enclosure withstands a dynamic pressure of twice the highest value recorded in the initial test.

§ 18.66 Tests of windows and lenses.

(a) Impact Tests. A 4-pound cylindrical weight with a 1-inch-diameter hemispherical striking surface shall be dropped (free fall) to

strike the window or lens in its mounting, or the equivalent thereof,* at or near the center. Three** of four samples shall withstand without breakage the impact according to the following table:

Lens diameter, (d), inches	Height of fall, inches
D < 4	6
4 ≤ D < 5	9
5 ≤ D < 6	15
6 ≤ D	24

Windows or lenses of smaller diameter than 1 inch may be tested by alternate methods at the discretion of MSHA.

(b) Thermal-shock tests. Four samples*** of the window or lens will be heated in an oven for 15 minutes to a temperature of 150°C (302°F) and immediately upon withdrawal of the samples*** from the oven they will be immersed in water having a temperature between 15°C (59°F) and 20°C (68°F). Three of the four samples*** shall show no defect or breakage from this thermal-shock test.

§ 18.67 Static-pressure tests.

Static-pressure tests shall be conducted by the applicant on each enclosure of a specific design when MSHA determines that visual inspection will not reveal defects in castings or in single-seam welds. Such test procedure shall be submitted to MSHA for approval and the specifications on file with MSHA shall include a statement assuring that such tests will be conducted. The static pressure to be applied shall be 150 pounds per square inch (gage) or one and one-half times the maximum pressure recorded in MSHA's explosion tests, whichever is greater.

In addition to MSHA requirements in the CFR [1], Reference [3] states:

For adhesive-bonded windows (lenses) the applicant design shall include:

- (a) Metal fastenings between the plane surfaces of a window and the enclosure; the fastening(s) on the interior plane shall leave an air gap of 1/32 to 1/16 inch.
- (b) The use of an adhesive having a hardness below that of the window during and after adhesive cure and at temperatures in the range of at least 0-150°C.
- (c) The use of an adhesive that mechanically, at least, bonds the perimeter of the window.
- (d) Adhesive formulator's certification that the adhesive is chemically compatible with the materials forming the enclosure-to-window interface(s).

*the equivalent thereof is no longer allowed [3].

**now Four of four [3].

***Window or Lens in its housing [3].

- (e) Adhesive formulator's procedures for use of the adhesive.
- (f) Manufacturer's certification that the adhesive shall be used in the exact manner prescribed by the formulator.

For lead-bonded windows (lenses) the applicant design shall

include:

- (a) Metal fastenings between the plane surfaces of a window and the enclosure; the fastening(s) on the interior plane shall leave an air gap of 1/32 to 1/16 inch.

In addition to the above requirements, MSHA is considering the adoption of performance tests for enclosure qualification, and some of them may affect the design of the enclosure. These new tests (which are still pending adoption) are:

- o a Structural Performance Test
- o a Ruggedness Test
- o an Environmental Test for Luminaires

The Structural Performance Test will demonstrate that the enclosure will contain the design pressure as now stipulated in Schedule 2G [1]. Except for luminaires, this test will not alter the design requirements. For luminaires, the new procedure may require that the luminaires be "on" continuously for 14 days prior to the Structural Performance (pressure) Test. The two-week exposure to light and heat prior to testing is to assure that rapid deterioration of the lens and sealant materials, which can be produced by heat and ultra-violet (UV) radiation, does not occur.

A test for ruggedness, if adopted, will establish new requirements which must be addressed by enclosure manufacturers. The test being considered [2] is based on roof-fall data in underground mines and upon impact of the mining machine with the rib or another vehicle. If adopted, this test will subject the enclosure to external loads which are characterized by impact, and these loads may govern the design of parts of the enclosure to which they are applied. No ruggedness requirements have been adopted by MSHA as of the writing of this guide, and so no specific requirements will be stated; however, the procedures for designing enclosures for ruggedness according to the recommendations in Reference 2 are included in this guide. MSHA requirements are subject to change, and current MSHA publications must always be addressed to determine the requirements in force at the time the enclosure is designed.

An environmental test for luminaires is being considered, which, in conjunction with the Structural Performance Test, will test for short-term deterioration of lens and sealant materials. If adopted, this test will

follow the structural performance test and will require that the luminaires be "on" continuously for 14 days in a high humidity environment and then subjected once again to a pressure test. Thus, luminaires will be "on" for 14 days under normal room temperature and relative humidity conditions, pressure tested, on for 14 days in a high humidity environment, and pressure tested again. The effect of the 28-day exposure to temperature, humidity, and UV radiation on the strength and ductility of the luminaire materials must be considered. These effects are addressed in Chapter 13, Materials of Fabrication.

4.0 DESIGN PRESSURES

4.1 Static Pressure

Unless higher than expected pressures occur during the Explosion Test, the Structural Performance Test will subject the enclosure to 150 psig. Because the magnitudes of pressures which can result from pressure piling cannot be predicted, it is proposed that the enclosure be designed under the assumption that pressure piling will not occur and that the guideline for avoiding pressure piling, given in Section 4.3, be followed. Using this approach, the design static pressure will be 150 psig.

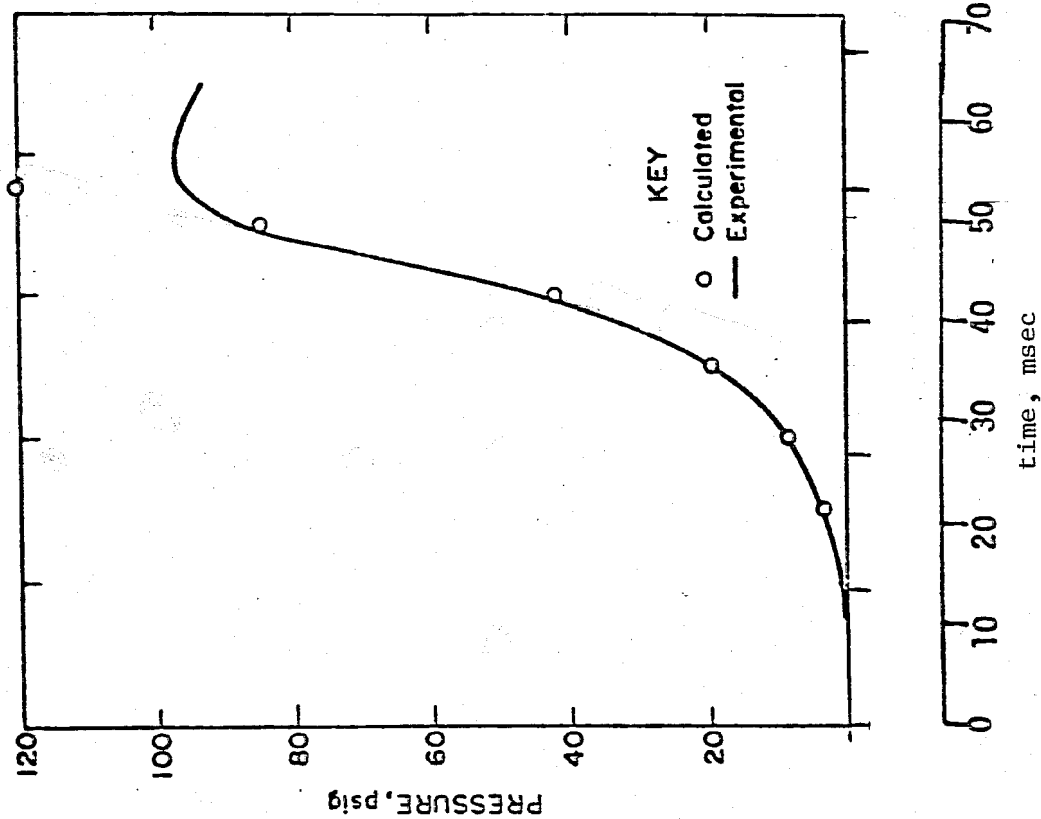
4.2 Dynamic Pressure

Dynamic pressures are produced in an enclosure during the Explosion Test. These pressures are routinely measured by MSHA during testing and have also been measured by other investigators. For a spherical enclosure, a typical pressure-time history, as given by Zabetakis [4], is shown in Figure 4.1(a). Comparison between experiment and theory is also given from the work of Perlee [5]. To analyze the response of an enclosure for the explosion pressure, its magnitude, rise time, and duration must be known. Methods for estimating the magnitude and rise time of the pressure are contained in the following sections. Because the enclosure is closed (usually tightly closed) during the Explosion Test and in service, the pressure does not decay rapidly; so, its duration can be treated as long relative to the response time of the enclosure.

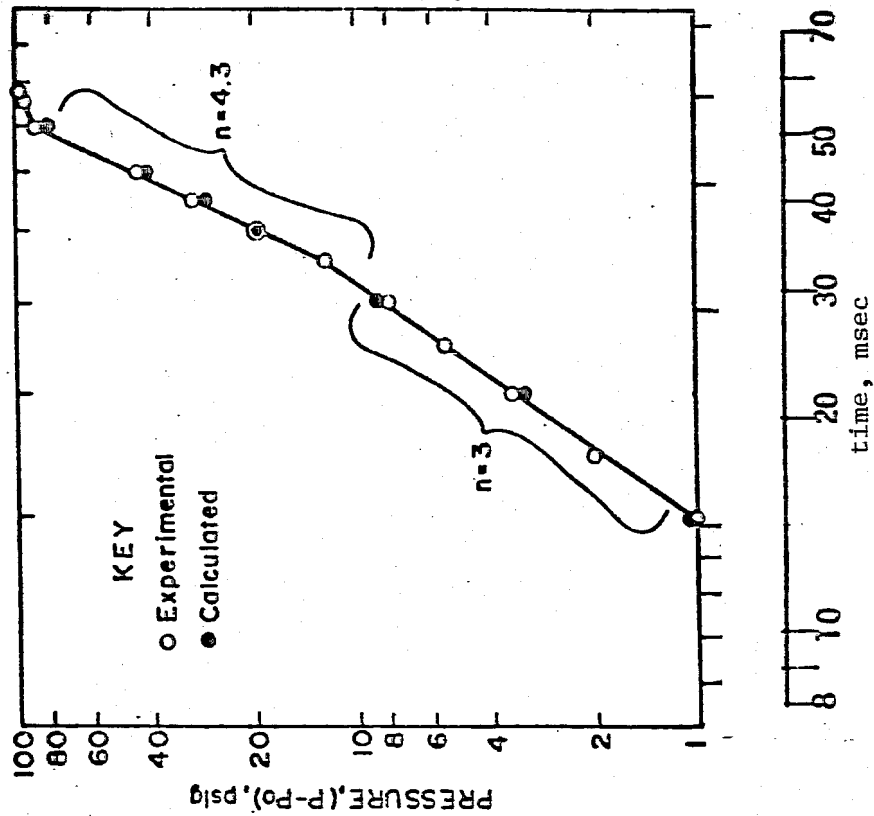
4.2.1 Peak Pressure

The peak pressure which theoretically can occur in a closed volume from the ignition of a mixture of methane and air at the stoichiometric* ratio is 117 psig. This pressure is produced by complete combustion and assumes that no heat loss to the walls of the enclosure and, of course, no pressure

*Ratio at which there is, theoretically, just sufficient oxygen in the air for complete combustion of all of the methane. This ratio is 9.5% for methane and air.



(a)



(b)

Figure 4.1. Pressure in a 9-Liter Spherical Chamber Produced By Ignition of a 9.6% (By Volume) CH₄-Air Mixture (Ref. 5)

piling occur. A more realistic upper limit for the pressure is the measured value shown in Figure 4.1. This pressure is for a 9.6% by volume methane-air mixture, which, in practice, gives the highest measured value of the explosion pressure. Also, this pressure was measured in a spherical chamber with central ignition, which is an idealized condition relative to most enclosure tests. Typical values of pressure measured by MSHA in the Explosion Test are 60-80 psig. Thus, a peak explosion pressure of 100 psig is suggested as a reasonable design value unless the designer has valid reasons for increasing its magnitude. For example, the dynamic design value might be increased if the particular geometry of the enclosure is expected to produce pressure piling (see Section 4.3).

4.2.2 Rise Time

The rise time of the explosion pressure, as well as its magnitude, is needed to calculate the response of the enclosure to these dynamic loads. Further, a short rise time generally produces a greater response in the enclosure than a long one. Therefore, an estimate of the minimum rise time is made for design purposes.

To determine the minimum rise time, it is convenient to use the maximum rise rate of the pressure. Again, the data in Figure 4.1 for spherical enclosures will be used. Using the minimum rise rate determined for spherical enclosures will not guarantee that a minimum rise time for all enclosures will be obtained, but, using a minimum estimated rise time is conservative, and so the approach is appropriate for design of nonspherical enclosures.

An approximate relationship between the time from ignition to peak pressure and the enclosure volume is given by Zabetakis [4] as

$$t = 75 [V]^{1/3} \text{ms} \quad (4.1)$$

where V is in ft^3 and t is in milliseconds. This is not a minimum rise time, but Equation 4.1 can be used to scale a minimum rise time or maximum rise rate determined for one enclosure to enclosures with different volumes. A minimum rise rate for a 9-liter enclosure can be estimated from Figure 4.1. Taking

the tangent to the steepest part of the curve in Figure 4.1(a) gives a pressure rise rate of:

$$\dot{p}_{MAX} = \frac{97 \text{ psi}}{10.5 \text{ ms}} = 9.2 \text{ psi/ms} \quad (4.2)$$

The same rate is given by the upper part of the curve in Figure 4.1(b). Combining Equations 4.1 and 4.2, the maximum rise rate for enclosures of other volumes is

$$\begin{aligned} \dot{p}_{MAX} &= 9.2 \text{ psi/ms} \frac{75}{75} \frac{\sqrt[3]{0.1352 \text{ ft}^3}}{\sqrt[3]{V \text{ ft}^3}} \\ \dot{p}_{MAX} &= \frac{4.72}{\sqrt[3]{V}}, \text{ psi/ms} \end{aligned} \quad (4.3)$$

Thus, the minimum rise time is

$$\begin{aligned} t_{r \min} &= \frac{p_{MAX}}{\dot{p}_{MAX}} \\ t_{r \min} &= 0.21 p_{MAX} \sqrt[3]{V} \end{aligned} \quad (4.4)$$

(p_{MAX} in psig; V in ft^3)

or for a maximum explosion pressure of 100 psig

$$t_{r \min} = 21 \sqrt[3]{V}, \text{ msec} \quad (4.5)$$

(V in ft^3)

Use Equation 4.5 unless the pressure is other than 100 psig.

4.3 Pressure Piling

The term pressure piling, as used in this report, refers to the increase in pressure in a compartmented enclosure, above the pressures that would occur in the same compartment without compartmentation. This pressure increase is a relative measure and may be considered abnormal compared to pressure obtained in a constant volume combustion process with a precombustion gas pressure at or very near standard atmospheric pressure. Note that compartmentation within an enclosure may be caused by the placement and arrangement of internal equipment as well as by the purposeful use of dividing walls and partitions.

4.3.1 Factors Affecting Pressure Piling

As discussed in Cox, et al. [2] the causes of pressure piling are not understood; certainly not to the degree that geometry, ignition source and location, and combustible gas mixture influences can be used to predict when pressure piling will occur, and if it does occur, what pressures will be obtained. Based on the work in Reference 2, we can, from a qualitative point of view, identify the factors that influence pressure piling and suggest a design approach.

The principal factors that influence pressure piling are:

- o geometry
- o compartmentation of the enclosure
- o gas type and concentration
- o precompression of the gas mixture
- o flow induced flame front acceleration
- o flame instabilities

Some observations about each of these principal influences and some recommendations for enclosure design to avoid pressure piling are given below:

Geometry

Observations - Aside from compartmentation, discussed next, geometry appears to be important only if the enclosure is long relative to its cross-sectional dimensions. For this case, when ignition occurs at one end, the flame front can accelerate down the length of the enclosure, even progressing to detonation in extreme cases.

Design Considerations - No test data is available which would allow definitive guidelines to be established for enclosure length to width (or height) ratios. In the absence of actual test data, it is suggested that the length, divided by the smallest cross-section dimension, not exceed four (4). For values of this ratio of four (4) or less, pressure piling is not likely to occur, unless other contributing factors are also present.

Compartmentation

Observations - Compartmentation of the enclosure is one of the leading causes of pressure piling. Pressure piling most often occurs in the smaller compartment after ignition in the larger one. Small areas or passages connecting the two compartments enhance the possibility of pressure piling. If there is a series of interconnected compartments, the pressure will have a tendency to increase as the flame propagates from compartment to compartment, reaching its maximum in the last one.

Design Considerations - To avoid pressure piling, the designer should eliminate compartmentation in the enclosure if possible. If the enclosure must be compartmented, either by partitions or equipment arrangement, then the openings connecting the compartments should be large. If large interconnecting passages are not possible, then the designer should consider "complete" isolation so that the flame does not propagate out of the single compartment in which ignition occurs. This can be accomplished by observing the flame path requirements [1] listed in Chapter 3.

Gas Type and Concentration

Observations - A mixture of methane and air near the stoichiometric ratio is assumed in this report. More volatile gases certainly may produce higher

pressures and have a greater tendency to produce pressure piling. Gases other than methane can be produced in an enclosure by heating, arcing or other means.

Design Considerations - If gases other than methane and air are considered likely, then special tests are recommended to determine an appropriate design pressure. In no case should pressures lower than those given in Sections 4.1 and 4.2 be used for design.

Ignition Source

Observations - Powerful ignition sources will produce higher pressures than normal (12V) spark ignition. Also, location of the ignition may influence the pressure. Central ignition in a regular enclosure appears to produce the highest pressures; whereas, end ignition in long slender enclosures appears to induce the highest pressures.

Design Considerations - Reduce the strength of the potential ignition source within the enclosure if possible. If the ignition source is strong, accept the fact that pressure piling is more likely in the enclosure and design for higher pressures.

Precompression of the Gas Mixture

Observations - Precompression will normally occur in compartmented and interconnected enclosures. Ignition in one compartment, particularly if it is the larger of the two compartments, may cause above atmospheric pressures to occur in the other compartment before ignition occurs. Final pressures are directly related to the amount of precompression, regardless of what causes the precompression to occur.

Design Considerations - Design considerations for compartmented enclosures apply to this factor as well. If compartmentation cannot be avoided, then precompression in the second compartment prior to ignition can be estimated conservatively as the final explosion pressure in the first chamber. This approach is very conservative and is based on the assumptions that (1) there is no resistance to flow between the first compartment and the second compartment during burning in the first compartment, (2) ignition in the second compartment occurs after burning is complete in the first

compartment, (3) initial pressure in the second compartment is equal to the final pressure in the first compartment and (4) there is high resistance to flow from the second compartment to the first compartment during burning in the second compartment.

For these assumptions the initial pressure in the second compartment is:

$$p_i = (100 + p_a) \times \frac{V_1}{V_1 + V_2} \text{ psia} \quad (4.6)$$

where p_a = ambient pressure in psia

V_1 = volume of the first compartment

V_2 = volume of the second compartment

Once the precompression has been estimated, the maximum combustion pressure (gage) in the second compartment for a methane and air mixture is

$$p_{MAX} = 7.8 p_i - p_a \quad (4.7)$$

These equations are indicative of the worst-case pressures which may be produced by precompression and are too conservative for normal design. High pressures predicted for compartmentation of the enclosure should encourage the designer to alter the design or test it to establish more realistic pressures.

Flame Front Acceleration

Observations - Acceleration of the flame front can be caused by several factors. These include flow-induced acceleration, turbulence and flame front instabilities. Acceleration of the gas flow may occur at the interconnecting passageway between compartments. This increases the energy release rate, which in turn may increase the flow rate and a positive feed back loop may occur. Flame front acceleration may also be produced by turbulence from obstructions in the flow or from flame front instabilities which can occur through gas concentration gradients, acoustic resonance (usually associated with venting) and from the normal differences between the burned and unburned gas at the interface.

Design Considerations - The designer should reduce the likelihood of flame front acceleration by following the design considerations for compartmentation and by minimizing obstacles which can create flow

turbulence. Clearly, the designer cannot eliminate necessary equipment inside the enclosure, nor can he always eliminate potential turbulence generators. He should concentrate primarily upon avoiding compartmentation of the enclosure by equipment placement and, where compartmentation is unavoidable, he should avoid unnecessary obstacles or constrictions at passageways between compartments.

4.3.2 Increased Dynamic Pressures

When one or more of the factors discussed in Section 4.3.1, are present in the enclosure design, the dynamic pressure must be increased from 100 psig to a minimum of 125 psig. This is the maximum pressure allowed by MSHA without design alteration or proof that the enclosure can withstand much higher (250 psig, min) dynamic pressure. This approach does not guarantee that the enclosure will not experience pressures above 125 psig, but it does assure that the enclosure is properly designed if it does pass MSHA testing. Explosion testing by the enclosure manufacturer, in an attempt to establish maximum pressures which may occur, usually is not recommended. MSHA is better qualified to determine pressure piling in the enclosure. An exception would be for compartmented enclosures in which pressure piling is very likely. For this case, pretesting by the manufacturers to better establish design pressures is recommended. The designer should concentrate primarily on (1) designing to avoid pressure piling and (2) designing for moderate pressures (125 psig) if pressure piling is expected.

5.0 DESIGN FOR STATIC LOADS

This chapter contains procedures for designing enclosures to withstand static internal pressures. Because no deformation criteria are specified by MSHA for static pressures, the design procedure is based upon a limit or yield line analysis. Further, plate stretching is ignored. It is ignored because MSHA requirements limit enclosure deformations during explosion testing to small values* and also because in plane boundary restraint is difficult to control in the design. MSHA requirements are subject to change, and the designer must always identify and apply current and applicable MSHA requirements to the design of an enclosure.

The size and shape of enclosures can vary greatly, but basically the geometry of the sides, bottom, and cover can be categorized as

- o rectangular
- o circular
- o cylindrical

The following paragraphs give design procedures for treating each of these basic geometries plus irregular geometries, which are combinations of rectangular sections. For enclosures of unusual shape, which do not fit neatly into one of the four categories addressed, the designer must seek more exact methods, or make gross approximations. In all cases, he used his engineering judgement when using these or other procedures.

5.1 Rectangular Plates

Solutions for rectangular plates under uniform static loads are based upon the maximum panel resistance computed from rigid, perfectly plastic theory. For rectangular panels, the plate resistance is related to the length to width ratio, yield stress, thickness and boundary conditions of the plate. Because the plate resistance is equal to the maximum load which the plate can withstand, a satisfactory design is achieved when:

*Only in design for ruggedness are large deformations (on the order of one plate thickness) permitted. Ruggedness is not now an MSHA requirement.

$$p a b = R_m \quad (5.1)$$

where p is the static design pressure of 150 psig as specified in Chapter 4, "a" and "b" are the plate dimensions and R_m is given by Table 5.1.

A more convenient form of Equation 5.1 is obtained if the plate thickness, h , is solved for. Using the definition of R_m from Table 5.1, the equation becomes:

$$h = \left[\frac{p a b}{3\sigma_y [STRF_a + E_j^a + C(STRF_b + E_j^b)]} \right]^{\frac{1}{2}} \quad (5.2)$$

Joint efficiencies, E_j^a and E_j^b , are given in Chapter 10 for welded joints and in Chapter 11 for bolted joints. $STRF_a$ and $STRF_b$ are strength reduction factors for penetrations given in Chapter 12. With proper reinforcement around penetrations, these factors are equal to 1.0.

5.2 Circular Plates

Resistance functions for circular plates also are based on rigid, perfectly plastic theory and define the pressure loading for which a fully plastic collapse mechanism first develops in the plate. The solution is taken from Reference 6, which is the original work by Newmark [7]. Modified to account for the joint efficiency at the boundary, the solution is:

$$R_m = 18.8 M_p^0 (1 + E_j^a) \quad (5.3)$$

where

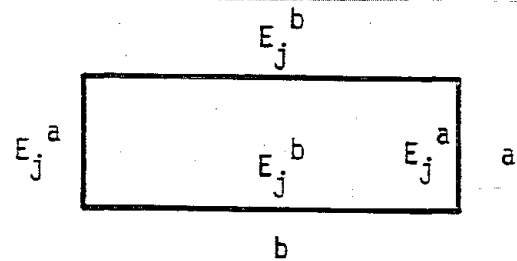
$$\begin{aligned} R_m &= \text{total pressure loading on the plate} \\ &= p(\pi R^2) \end{aligned}$$

$$M_p^0 = \text{unit plastic moment} = \frac{1}{4} \sigma_y h^2$$

Table 5.1 Panel Resistance

$$R_m = 12 M_p^O [STRF_a + E_j^a + C(STRF_b + E_j^b)]$$

a/b	c
1.0	1.00
0.9	1.02
0.8	1.07
0.7	1.17
0.6	1.29
0.5	1.50



M_p^O = Unit plastic moment

$$= \frac{1}{4} \sigma_y h^2$$

h = panel thickness

σ_y = panel yield strength

E_j^a, E_j^b = joint efficiencies for sides a and b, respectively

= 0 for simple support

= 1.0 for bend

E_j^a and E_j^b are given in Chapter 10 for welded joints and in Chapter 11 for bolted covers.

$STRF_a, STRF_b$ = strength reduction factors for penetrations

$STRF_a$ and $STRF_b$ are computed in Chapter 12 for panels with penetrations and otherwise are equal to 1.0.

σ_y = material yield strength

h = plate thickness

E_j^a = joint efficiency at the boundary as defined in Chapter 10 for weld joints and Chapter 11 for bolted covers.

Solving for the plate thickness, Equation 5.3 can be rewritten as:

$$h = \left[\frac{p R^2}{1.5 \sigma_y (1 + E_j^a)} \right]^{1/2} \quad (5.4)$$

5.3 Cylinders

Cylinders designed for 150 psig will have thin walls, so that standard elastic formulas for thin wall cylinders can be used for design. Stresses will be uniform across the wall thickness, h , and the design conditions can be based on the circumferential wall stress just reaching some prescribed design stress. A design stress just below the yield stress ($95\% \sigma_y$) is chosen because, once yielding occurs, the deformations will be controlled only by the effect of end restraints and the increase in strength of the material produced by strain hardening. Thus, the following pressure-thickness relationship is recommended for cylinders with a mean radius, R :

$$p = \frac{0.95 \sigma_y h}{R} \quad (5.5)$$

or

$$h = \frac{1.05 p R}{\sigma_y} \quad (5.6)$$

These formulas should be used with the minimum yield stress of the material to assure that permanent deformations do not occur. Local yielding may occur at the ends of the cylinder or around penetrations, but the deformations will be small and should fall well within current MSHA requirements.

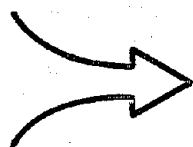
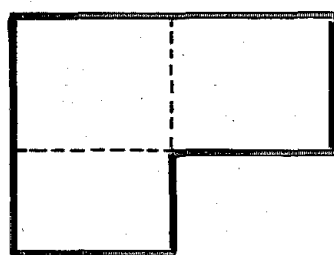
5.4 Irregular Geometry

Irregular geometry is defined here as combinations of rectangular plates such as shown in Figure 5.1. These geometries are treated by subdividing the plate along the dashed lines and analyzing each section of the plate individually. Three basic plate configurations are present in Figure 5.1 and their resistances are given in Table 5.2. Note that the common boundaries of the plates are assumed to be guided (which prevents the use of Table 5.1) and that hinge patterns in the plates are shown as dotted lines. The constraint of adjacent plate segments forces the hinges patterns shown for segments (aa) and (bb). For segment (cc), use $Y/a = 1.0$ for those cases in which the parameter

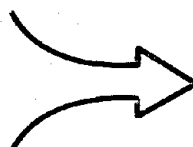
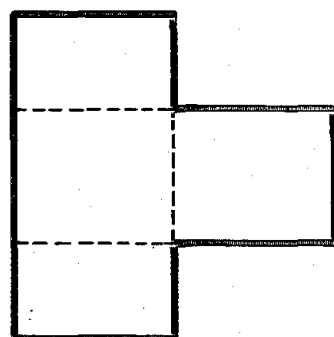
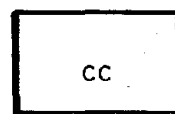
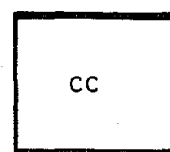
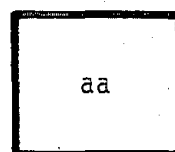
$$\frac{a}{b} \left(\frac{E_j^a + 1}{E_j^b + 1} \right)^{\frac{1}{2}}$$

in Table 5.2 is less than 0.5. Note that p in Table 5.2 is the applied pressure and other parameters are defined on the figures or in Table 5.1.

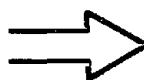
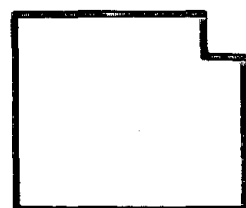
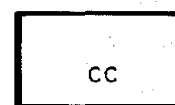
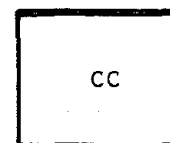
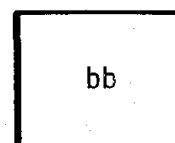
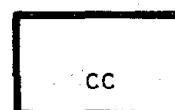
To design an irregular plate, with a geometry similar to that shown in Figures 5.1 (a) and (b), the plate is segmented and the thickness of each segment is determined individually. Then, the maximum value is taken as the thickness for the entire plate. For plates similar to those in Figure 5.1, (c) and (d), the plate boundary is adjusted to obtain a uniform geometry, and the resistance function in Table 5.1 is used for design. In Figures 5.2, (c) and (d), the joint efficiency which applies to the original plate boundary is used for the adjusted plate as well. Note that the resistance functions in Table 5.2 do not have strength reduction factors as used in Table 5.1. For these formulas, any penetrations in the plates must be designed to develop full plate strength according to the procedures in Chapter 12.



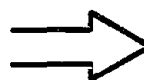
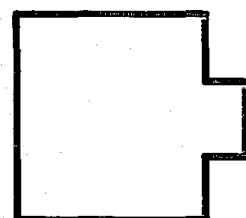
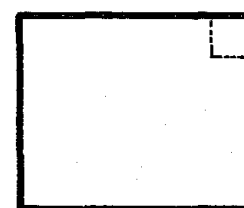
segment the
plate
(a)



segment the
plate
(b)



adjust the
plate boundary
(c)



adjust the
plate boundary
(d)

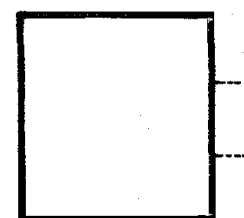
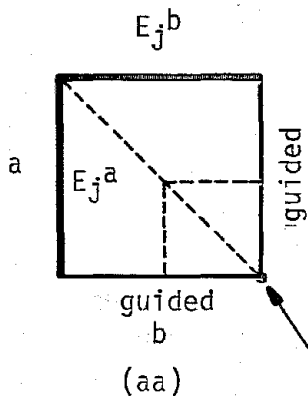


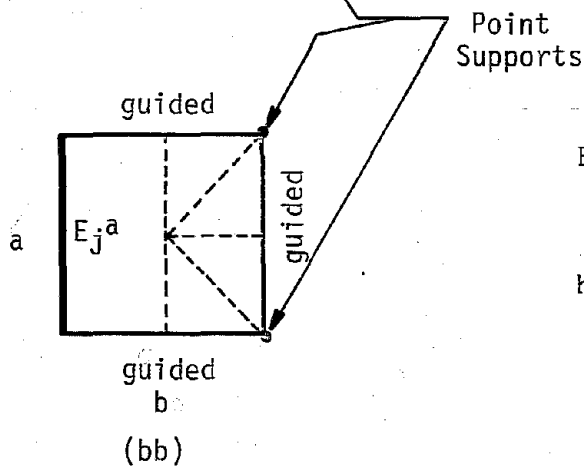
Figure 5.1. Irregular Plate Geometries

Table 5.2 Resistance Functions for Sections of Irregular Plates



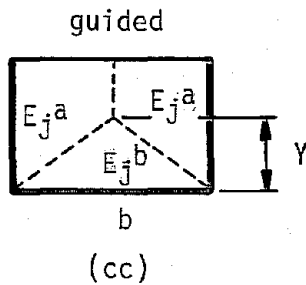
$$R_m = 4 M_p^0 [(E_j^a + 11/6) \frac{a}{b} + (E_j^b + 11/6) \frac{b}{a}]$$

$$h = \sqrt{\frac{p ab}{\sigma_y [(E_j^a + 11/6) \frac{a}{b} + (E_j^b + 11/6) \frac{b}{a}]}}$$



$$R_m = \frac{24}{7} M_p^0 [(E_j^a + 17/6) \frac{a}{b} + 11/6 \frac{b}{a}]$$

$$h = \sqrt{\frac{7p ab}{6\sigma_y [(E_j^a + 17/6) \frac{a}{b} + 11/6 \frac{b}{a}]}}$$



$$R_m = \frac{5M_p^0 (E_j^b + 1) \frac{b}{a}}{(Y/a)^2}$$

$$h = \sqrt{\frac{4p ab (Y/a)^2}{5\sigma_y (E_j^b + 1) \frac{b}{a}}}$$

$$\frac{a}{b} \left[\frac{E_j^a + 1}{E_j^b + 1} \right]^{1/2}$$

Y/a

.5
.6
.8
1.0
2.0
4.0

1.0
.895
.745
.635
.350
.175

6.0 DESIGN FOR DYNAMIC LOADS

Dynamic effects produced by transient loads can be important when the rise time of the loading is less than four times the fundamental period of the structural element. Methods for including dynamic effects in the design of enclosures for the explosion pressures are given in this chapter.

6.1 Elastic Behavior

If the response is elastic, or experiences only minor plasticity (which are conditions imposed by Schedule 2G[1]), the effect of the dynamic loads can be estimated from Figure 6.1. This figure gives the dynamic effect in terms of a dynamic load factor, DLF. $(DLF)_{MAX}$ is the maximum deflection produced by the dynamic loading divided by the deflection produced by a static load of the same magnitude.

To determine the DLF, one must know the rise time of the loading, t_r , and the fundamental frequency of the structural element, T . The rise time of the explosive loading is determined by the procedures in Section 4.2. In general, the shortest rise time will produce the greatest dynamic effect; however, dips in the DLF do occur at even multiples of t_r/T . Because the rise times can vary, the minimum rise time should be established, and the largest DLF for this rise time or any longer rise time should be chosen as the appropriate value. For values of t_r/T greater than 4.0, (the limit of Figure 6.1) Equation 6.1 can be used to estimate $(DLF)_{MAX}$.

$$(DLF)_{MAX} = 1 + \frac{1}{2\pi(t_r/T)} \quad (6.1)$$

The fundamental frequency of the structural component can be calculated from equations in Table 6.1 and Table 6.2. These tables contain formulas for the fundamental frequencies of rectangular plates, circular plates, and cylinders. Note that for a cylinder, the fundamental mode corresponds to a uniform radial expansion and is not a bending mode. A uniform radial expansion is the type of response which a uniform internal pressure will produce in the cylinder.

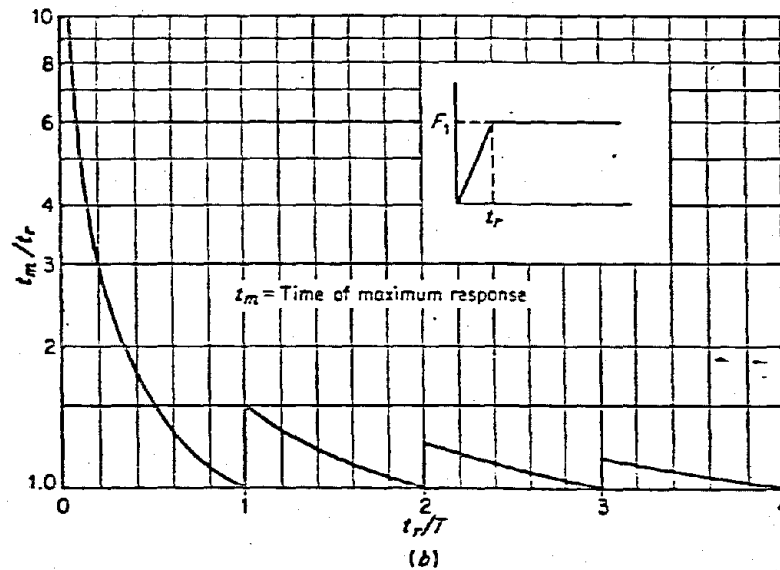
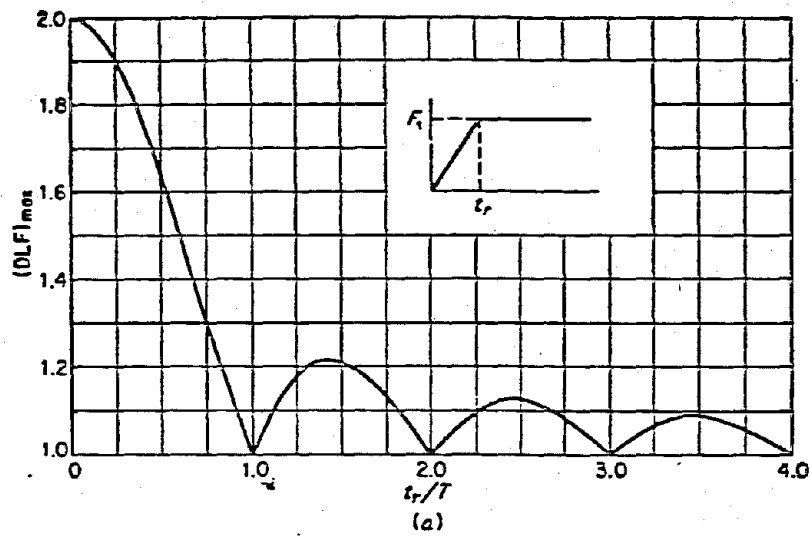
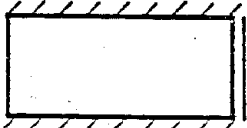
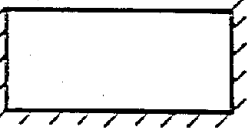
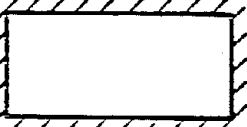
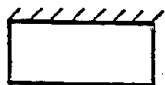


Figure 6.1. Maximum Response of One-Degree Elastic Systems (Undamped) Subjected to Constant Force with Finite Rise Time [From Reference (6)]

Table 6.1. Fundamental Circular Frequencies for Rectangular Plates (Ref. 8).

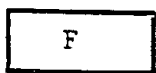
CASE	BOUNDARY* CONDITIONS	$\omega b^2 \sqrt{\rho h/D}$ FOR VALUES OF b/a				
		0.4	0.6667	1.0	1.5	2.5
1.		11.45	14.26	19.74	32.08	71.56
2.	 F $\nu = 0.3$	10.13	10.67	11.68	13.71	18.80
3.	 F	12.13	17.37	28.95	56.35	145.50
4.	 $\nu = 0.3$	22.58	23.02	24.02	26.73	37.66
5.		23.65	27.01	35.99	60.77	147.80



CLAMPED



SIMPLE SUPPORT



FREE

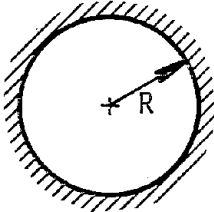
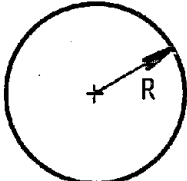
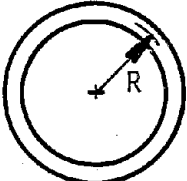


b

a

$$D = \frac{Eh^3}{12(1-\nu^2)} \quad \rho = \text{mass density}$$

Table 6.2 Fundamental Frequencies of Circular Plates and Long Cylinders

Geometry	Circular Frequency
	$\omega = \frac{10.22}{R^2} \sqrt{\frac{D}{\rho h}}$
S.S.  $\nu = 0.3$	$\bar{\omega} = \frac{4.98}{R^2} \sqrt{\frac{D}{\rho h}}$
	$\omega = \frac{1}{R} \sqrt{\frac{E}{\rho (1 - \nu^2)}}$ (breathing mode)

$$D = \frac{Eh^3}{12(1 - \nu^2)}$$

ρ = mass density

h = thickness

For irregular plate geometries such as shown in Figure 5.1, the data in Table 6.1 can be used to bound the frequencies, or other sources of vibration data, such as Reference 8, can be used. If textbook solutions are not found to be satisfactory, more general methods, such as finite elements, can be used to treat irregular geometries.

Once the DLF has been determined from Figure 6.1, or Equation 6.1, it is used to calculate an equivalent static pressure from the maximum explosion pressure, $p_{exp.}$, determined in Section 4.2 and 4.3. The equivalent static pressure is computed as:

$$p_{EQ} = p_{exp.} \times (DLF)_{MAX} \quad (6.2)$$

The pressure given by Equation (6.2) is an equivalent static pressure to which the plate in the enclosure must be designed in order to pass MSHA explosion testing. Thus, the static design pressures of Chapter 5 can be used for p_{EQ} , just as they were used for the 150 psig static pressure, except that deflections in the plates must now be limited to 0.040 in/ft to satisfy MSHA requirements (Chapter 3). No deflection limits were placed on the static design procedures of Chapter 5.

Jones and Walters [9] have demonstrated that a plate solution, based on yield line theory and a square yield curve which inscribes the maximum normal stress yield curve, gives a good lower bound for deflections in pressure-loaded clamped plates. Such a solution gives a reduction in the plate resistance, related to the maximum normal stress yield curve, of 0.618. Because the equations in Chapter 5 are based on the maximum normal stress yield criterion, the resistance functions of Tables 5.1 and 5.2 must be reduced by 61.8%. This is equivalent to increasing the equivalent static pressure to:

$$p_{EQ} = \frac{p \times (DLF)_{MAX}}{0.618} = p \times (DLF)_{MAX} \times 1.62 \quad (6.3)$$

A solution based on the pressure of Equation (6.3) should assure that the deflection criteria, set by MSHA for the explosion test, are met.

7.0 DESIGN FOR RUGGEDNESS

A ruggedness requirement does not now exist for Schedule 2G enclosures; however, the MSHA and the USBM are considering such a requirement and these design procedures adopt the requirements proposed in Reference 2. Ruggedness requirements suggested in Reference 2 are specified in terms of kinetic energy, because damage to enclosures is most often caused by impact. The ruggedness requirements, specified according to exposure of the enclosure surfaces, are summarized in Table 7.1.

Table 7.1. Ruggedness Requirements

Surfaces exposed to roof fall:	$KE = 3700 \frac{\text{ft-lb}}{\text{ft}^2}$
Surfaces exposed to side impact:	$KE = 8,000 \text{ ft-lb}$
Protected surfaces:	$KE = 800 \text{ ft-lb}$

An allowable deflection under impact conditions must also be specified. Calculations in Reference 2 showed that maximum permanent deflections of one plate thickness gave reasonable design values. To restrict the deflections further increases the plate thickness far beyond that required for internal pressures. Thus, the ruggedness design procedures in this Chapter are based on a permanent deformation of one plate thickness.

To design an enclosure which satisfies the ruggedness requirements of Table 7.1, the designer must consider the bending of flat panels in the enclosure which are subjected to normal impact loading, the bending of cylindrical enclosures under radial impact loads, and the buckling of panels which are parallel to the loading direction. Each of these categories is addressed separately.

7.1 Flat Panels with Transverse Loading

Design of flat panels, to meet the ruggedness requirements of Table 7.1, will utilize the resistance functions, R_m , given in Tables 5.1 and 5.2 and Equation 5.3. The kinetic energy which must be absorbed by the panel is

equated to the plastic strain energy for a permanent center deflection equal to the plate thickness, h . The general equation is:

$$KE = R_m \cdot h \quad (7.1)$$

For convenience in design, Equation 7.1 can be rewritten to solve for the plate thickness h . For example, if R_m from Table 5.1 is substituted into Equation 7.1 (and making the additional substitution of $\frac{1}{4} \sigma_y h^2$ for M_p^0), we obtain:

$$h = \left[\frac{KE}{3\sigma_y [STRF_a + E_j^a + C(STRF_b + E_j^b)]} \right]^{1/3} \quad (7.2)$$

Similar equations can be derived for the plate segments of Table 5.2 and for circular plates [Equation 5.3]. The resulting equations are all given in Table 7.2. For irregular plates, comprised of more than one segment, the best approach will be to first size the plate for internal pressures according to the procedures in Chapters 5 and 6. Then, the rugged requirement is checked by equating the kinetic energy to sum the deformation energies absorbed by the plate segments. For segmented plates Equation 7.1 becomes:

$$KE = h \cdot \sum_{i=1}^N R_{m_i} \quad (7.3)$$

where N is the number of plate segments and the plate thickness is uniform. An iterative process may be required to satisfy Equation 7.3.

7.2 Buckling of Enclosure Sides

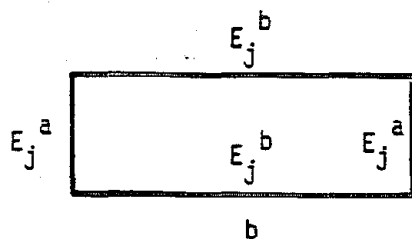
7.2.1 Flat Plates

The effective width method of Reference 10 is adopted in this guide for determining whether or not the sides of an enclosure, which support the loaded surface, will buckle under the action of the applied loads. It assumes that the total load is carried by two strips at the supported edges of the side plate as shown in Figure 7.1.

For edges which are well supported, as in an enclosure, the ultimate edge load which the plate can carry is

Table 7.2 Equations for Ruggedness

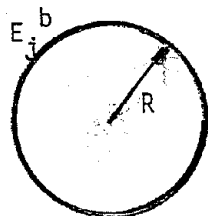
Rectangular
Plates



$$h = \left[\frac{KE}{3\sigma_y [STRF_a + E_j^a + c(STRF_b + E_j^b)]} \right]^{1/3}$$

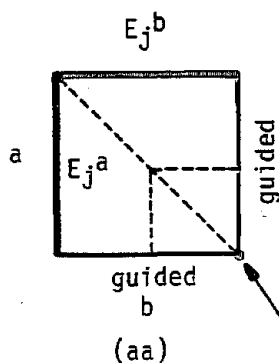
For c , E_j^a , E_j^b , $STRF_a$ and $STRF_b$ see Table 5.1.

Circular
Plates

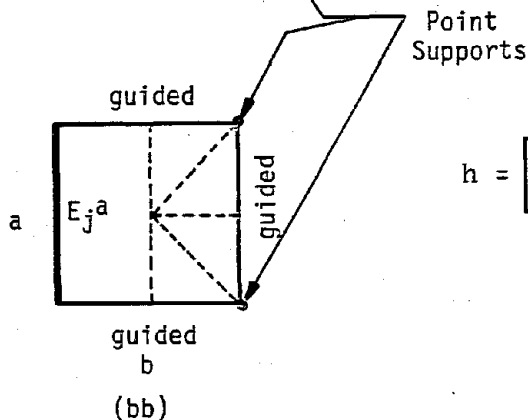


$$h = \left[\frac{KE}{4.7 \sigma_y (1 + E_j^a)} \right]^{1/3}$$

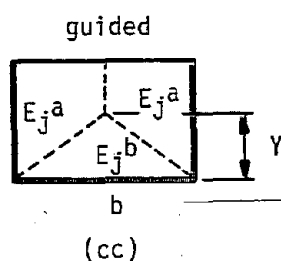
Segments of
Irregular
Plates



$$h = \left[\frac{KE}{\sigma_y [(E_j^a + 11/6) \frac{a}{b} + (E_j^b + 11/6) \frac{b}{a}]} \right]^{1/3}$$



$$h = \left[\frac{7 KE}{6\sigma_y [(E_j^a + 17/6) \frac{a}{b} + \frac{11}{6} \frac{b}{a}]} \right]^{1/3}$$



$$h = \left[\frac{7 KE}{5\sigma_y [(E_j^b + 1) \frac{b}{a}]} \right]^{1/3}$$

For (Y/a) see Table 5.2

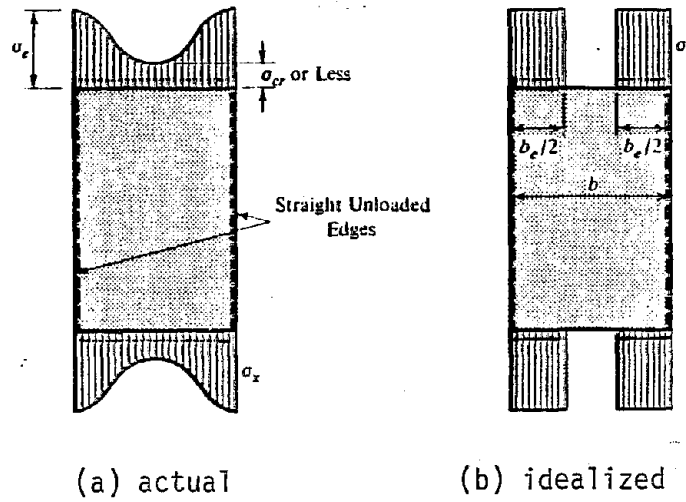


Figure 7.1 Stress Distributions at the Loaded Edges

$$\bar{P} = \sigma_y b_e h \quad (7.4)$$

where σ_y is the yield stress of the material

b_e is the effective width

h is the plate thickness

The effective width, b_e , is given by several formulas which have been shown to fit plate buckling behavior. Szilard [10] suggests that the following formulas be used.

$$b_e = b \left[\frac{\sigma_{cr}}{\sigma_y} \right]^{1/3} \quad \text{for } a/b \leq 3 \text{ and } 2 \leq \frac{\sigma_y}{\sigma_{cr}} \leq 20 \quad (7.5)$$

$$b_e = b \left[1.2 \left(\frac{\sigma_{cr}}{\sigma_y} \right)^{0.4} - 0.65 \left(\frac{\sigma_{cr}}{\sigma_y} \right)^{0.8} + 0.45 \left(\frac{\sigma_{cr}}{\sigma_y} \right)^{1.2} \right] \quad \text{for } \frac{a}{b} > 3 \quad (7.6)$$

$$b_e = \frac{b}{3+\nu} \left(2 + \frac{\sigma_{cr}}{\sigma_y} \right) \quad \text{for } a = b \quad (7.7)$$

To use the formulas, the critical buckling stress for the plate is needed. It is given by Equation 7.8

$$\sigma_{cr} = \frac{\lambda_{cr} \pi^2 E}{12(1-\nu^2)} \left(\frac{h}{b}\right)^2 \quad (7.8)$$

where λ_{cr} = minimum value of $(m + \frac{1}{n} \frac{a^2}{b^2})^2$

m = number of halfwaves in the buckled plate

For a rectangular enclosure, $\bar{P}$ is computed for the four sides which support the loaded surface and summed to find the total load that the enclosure can support before the sides buckle. This value must be greater than the maximum resistance of the loaded face or:

$$\sum_{i=1}^N \bar{P}_i > R_m \quad (7.9)$$

for N sides and a loaded surface of resistance R_m . Clearly, if this equation is not satisfied the thickness of the side plates must be increased or the side plates must be reinforced by stiffeners.

7.2.2 Cylinders

The longitudinal resistance of a cylinder is:

$$\bar{P} = \sigma_{cr} A = \sigma_{cr} \pi (R_o^2 - R_i^2) \quad (7.10)$$

where R_o = outside radius of the cylinder

R_i = inside radius of the cylinder

σ_{cr} = buckling stress $\leq \sigma_y$

An approximate formula for longitudinal buckling of a cylinder is given by Roark [11] as:

$$\sigma_{cr} = \frac{0.3Eh}{R} \quad \text{for } \lambda > 5.16 (Rh)^{1/2} \quad (7.11)$$

where R = mean radius

h = cylinder wall thickness

λ = cylinder length

For most cylindrical enclosures, one will probably find that σ_{cr} is much greater than σ_y .

7.3 Cylinders with Transverse Loading

Approximate solutions for the deformations of cylinders produced by external impact are given in Figure 7.2. The solutions were developed by determining the strain energy absorbed during deformation of the cylinder, in the pattern shown in Figure 7.3, and equating it to the kinetic energy of the impact. In Figure 7.2(a) the strain energy was assumed to be that produced only by bending along the hinge lines of Figure 7.3. In Figure 7.2(b) it was assumed that both stretching and bending of the cylinder occur. The true solution should lie in between these two extremes, but we were not able to confirm this assertion by comparison with test data. Considering only bending of the cylinder, should give an upper bound on the amount of deformation which is produced in the cylinder by the external loading. The deformation is expressed as ΔR_0 , the maximum radial deformation which occurs at mid-length of the cylinder. Considering both bending and stretching should give a lower bound on the deformation.

The use of these two solutions is shown by example in Chapter 14. To enter the figures one must compute the non-dimensional quantities:

$$KE/M_p^0 L, R/L \text{ and } R^3/L^2 h$$

The kinetic energy, KE, is the total kinetic energy determined from Table 7.1. For roof falls, multiply the kinetic energy per square foot by the lateral projected area of the cylinder, $2RL$. For lateral impact or protected enclosures, take the total kinetic energy as given in the table. M_p^0 is the unit plastic moment of the cylinder and is the same as M_p^0 defined in Table 5.1. All other variables in the non-dimensional quantities are based on the geometry of the cylinder and are defined in Figure 7.3

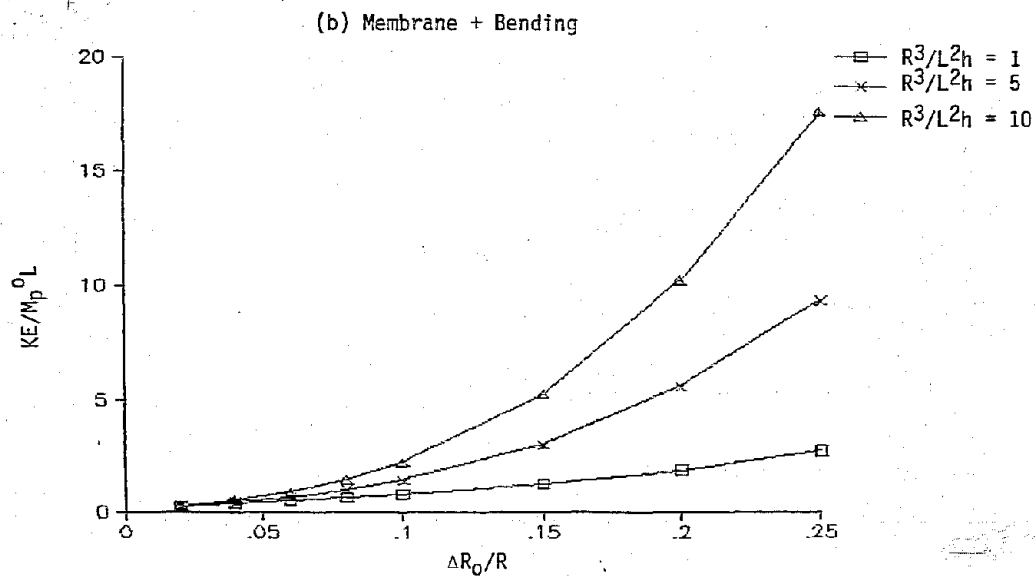
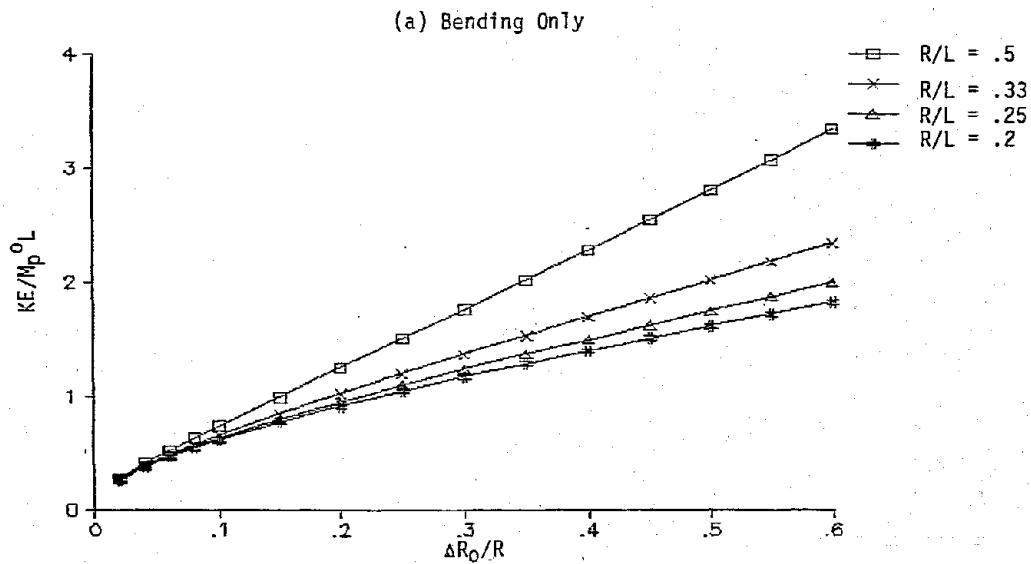


Figure 7.2 Deformation of a Cylinder from External Impact Loading

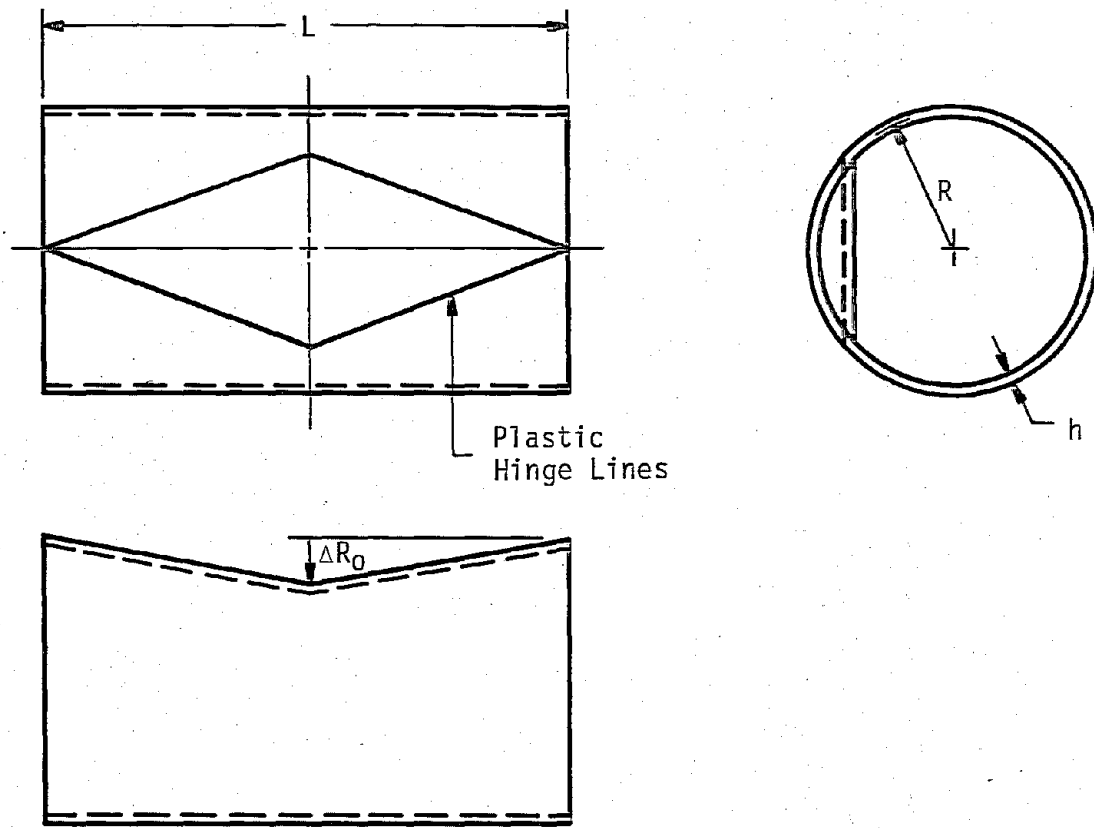


Figure 7.3 Geometry of the Deformed Cylinder

8.0 DESIGN OF WINDOWS AND LENSES

8.1. General

Windows in explosion-proof enclosures, subsequently referred to in this chapter as enclosures, require careful design, fabrication, and installation of the window, window seat, retaining ring and seals. The procedures in this chapter have been formulated to assure that windows and lenses designed according to this Guide will meet or exceed MSHA requirements [1]. The designer of the enclosure must assure that the window is adequate for the design conditions of the enclosure, particularly the internal pressure, temperature, point impact, thermal shock, and aging produced by the operational environment.

Each window should be individually certified by the enclosure supplier or window fabricator, depending on whether the enclosure supplier fabricates the windows himself, or purchases them from a window fabricator. The certification accompanying each window shall include the following items:

- Name of window fabricator (e.g. Corning Glass)
- Type of material (e.g., borosilicate glass, PYREX*)
- Design pressure and temperature (e.g., 150 psig, 400°F)
- Nominal size (e.g. 3/4 x 4 inches)
- Quality Control inspection data (e.g. year of manufacture, serial number, inspector's name).

Windows shall have the design temperature, design pressure, year of manufacture and fabricator's initials molded in raised letters on the viewing surface, sandblasted on the edge of the window, or printed on a transparent label bonded to the external surface.

The windows covered by this guide are intended for use only in enclosures with window service conditions defined by:

- a. Maximum dynamic pressure (P_{dyn}) generated by explosion of gas mixture inside the enclosure.
- b. Design pressure (P) equal to 150 psig.

*Trade name

- c. Maximum temperature (T_d) generated by internal heat source (equal to the design temperature).
- d. Pressure cycles generated by repeated explosions at design pressure and temperature.
- e. Thermal shock generated by immersion of window at design temperature to water at 59°F.
- f. Physical shock generated by the point impact of a blunt object at the center of the window.
- g. Thermal aging produced by at least three years of service at in-service operating temperatures.

The windows covered by this design guide are not intended for enclosures where any of the following restrictions on design parameters are exceeded:

- a. The operating temperature shall not exceed 302°F on the exterior of the enclosure.
- b. The fluids contacting the surface of the window shall be only those typically found in an underground mine environment (i.e., humid air, mine water, and lubricating and hydraulic oils used on mechanized equipment).

8.2 Material

Windows shall be fabricated only from materials suited for the operational environment encountered in mines. The suitability of a material for this service is based either on documented extensive past experience, or on exhaustive evaluation by a materials testing laboratory in simulated operational environment. At the present time, materials listed in Chapter 13 are considered acceptable for fabrication of windows covered by this Guide.

8.3 Geometries of Glass Windows

8.3.1 The glass windows shall have one of the standard geometries shown in Figures 8.1, 8.5, and 8.7.

8.3.2 Windows with other geometries may be utilized in explosion proof enclosures providing that the nonstandard geometry is first qualified by design procedure of 8.3.3 and tests of 8.3.4.

8.3.3 a. The window of nonstandard geometry shall be designed according to 8.4 for the design pressure determined in Chapter 4 with nominal design stress $\leq$ 1000 psi for annealed, or $\leq$ 2000 psi for tempered glass condition.

b. The test fixture shall be designed to retain and seal the window against 400 psi internal pressure without permanent deformation of the fixture. The mounting and sealing of the window shall satisfy the requirements of 8.5 and 8.6.

c. A minimum of one test fixture and nine windows shall be procured for the qualification tests.

d. The windows shall be successively mounted in the test fixture and subjected individually to qualification tests of 8.3.4.

8.3.4 The qualification tests shall consist of:

a. Pressurizing the test fixture internally to 400 psi for 1 hour with water at room temperature. The internal pressurization is performed successively on three windows. No leakage through the window or seal shall occur.

b. Heating the interior of the test fixture until the temperature on the exterior surface of the window reaches 302°F. At that time, the whole enclosure is submerged for one minute in water at 59°F. The thermal shock test is performed successively on three windows. If any window cracks as a result of the thermal shock tests, the window mounting arrangement must be redesigned to reduce the thermally induced stresses.

c. Impacting the window at its center with a steel striker. The 4.0 lb striker is equipped with a 1 inch diameter hemispherical impacting surface. The striker shall be dropped from the elevation specified § 18.66 of Reference 1 (see Chapter 3). After impact testing the window shall be subjected to thermal shock testing per 8.3.4b, followed by internal pressurization to 300 psig. There shall be no leakage through the window or seal. These series of tests are to be performed successively on three windows. If any window fails during the test series, the design of the window assembly shall be modified to correct the deficiencies.

8.4 Design of Glass Windows

8.4.1 The thickness of a window shall be based primarily on the design pressure and secondarily on the design impact resistance.

8.4.2 The design pressure of the window shall be the static design pressure of 150 psig as specified for the enclosure in Chapter 4.

8.4.3 The calculated value of maximum nominal tensile stress in the window at design pressure shall not exceed 1000 psig for annealed glass, and 2000 psig for tempered glass.

8.4.4 The maximum nominal tensile stress in the window shall be calculated with the help of expressions shown in Figures 8.2, 8.3, 8.4, and 8.6. For plane windows, the stress coefficient for free edge condition shall be applied. These expressions neglect stress generated by (a) differential thermal expansion of glass, (b) elastic deformation of enclosure, and (c) peak stresses generated by sharp corners. For these reasons, the peak stresses in the window may exceed the nominal tensile design stress by as much as 100%. This, however, is acceptable as the nominal design stress of 8.4.3 is sufficiently below the ultimate strength of glass to allow for the presence of peak stresses whose values exceed the nominal stress by as much as 300 percent; nevertheless, thermally induced stresses should be minimized according to the procedures in Chapter 9.

8.5 Mounting of Glass Windows

8.5.1 The window may be mounted in the enclosure, or in a removable cover mechanically fastened to the enclosure.

a. The window shall be restrained against internal design pressure and external impact loads by being securely clamped between structural components of the enclosure. Typical designs for mounting are shown in Figures 8.8, 8.12 through 8.14 and 8.20.

b. Plane windows shall extend a minimum of 0.5 inches past the inner edge of the metallic seat to provide adequate bearing surface for the window under design pressure.

c. The metallic components of the window seat pressing against the window gasket shall be flat within 0.010 inches and shall have a surface finish of at least 64 rms or better.

d. The external window seat on the enclosure shall be designed for strength and stiffness according to Figure 8.23 when the enclosure is internally pressurized to design pressure. The procedures in Figure 8.23 assure that the window seat does not rotate locally more than 0.5 degrees at design pressure.

e. Internal window seats shall be designed to withstand external impact loads according to Figure 8.24.

f. Window seats shall also be capable of withstanding precompressed loads of 8.5.2c or 8.5.3b. Design for precompression loads according to Figure 8.26. The procedure of Figure 8.26 limits the stress produced by precompression loads to $2/3$ of the flange material yield strength.

g. Direct contact between glass and a rigid metallic seat surface is not allowed as high points on the glass surface and on the metallic seat could generate excessively high peak stresses in glass, causing it to fail prematurely.

h. Direct contact between glass and metallic seat surfaces shall be prevented by interposition of material that, by conforming to unevenness of both the glass and the metallic seat, (1) prevents point contacts from generating peak bearing stresses in the window (2) assures a secure fit for the window without excessive clamping force, and (3) acts as a secondary seal.

i. The material interposed between the glass window and metallic seat surfaces can take the form of a preformed gasket bonded to the metallic seat, or a cast-in-place bearing pad bonded to both the window and the seat.

8.5.2 The preformed gasket may be fabricated from any material meeting the requirements of Chapter 13. The gasket shall be formed by either (a) cutting a continuous strip of material from commercially available sheets of material, or by (b) placing a uniformly thick layer of gasket material on the surface of the metallic seat and curing it prior to mounting of the window in the enclosure.

a. The peel strength of bond between the preformed gasket and the metallic seat shall exceed 10 lb/inch of gasket width. The peel strength shall be established by procedure 8.5.2b.

b. The peel strength of bond between the performed gasket and the seat material shall be determined by standard test methods ASTM-D-903 or C-794,

depending on whether method 8.5.2(a) or 8.5.2(b) was used to fabricate the gasket. Both tests are to be conducted at 150°C on test specimens heat aged at 150°C and 100 percent RH for 1000 hours.

c. The clamping forces exerted by a hold down ring on a window sandwiched between preformed gaskets and the metallic seat shall be adequate to restrain the window against lateral or axial displacement under vibration with 60 Hz frequency and 0.06 inches single amplitude. The average bearing stress in the preformed gasket generated by precompression shall not exceed 2000 psi. In the calculation of the bearing stress, it can be assumed that the clamping force exerted by the hold-down ring on the window is acting uniformly around the window's circumference. The clamping force exerted by torque on the bolts is shown in Figure 8.22.

d. Positive mechanical detents shall be incorporated into the window seat assembly to prevent excessive clamping force on the window during assembly.

e. Both the bolts and the hold-down ring shall be structurally adequate to withstand the forces generated by (1) precompression of the gasket and (2) internal design pressure, or external impact depending on whether the hold down ring is acting upon the external or internal surface of the window. Design procedures are the same as those for the enclosure seat in 8.5.1d,e, and f.

8.5.3 The cast-in-place bearing pad shall consist of an elastomeric material which meets the requirements of Chapter 13. The strength of bond between the cast-in-place bearing pad material and both the glass window and the metallic seat shall meet the requirements of 8.5.2.a. The peel strength of bond shall be established by procedure 8.5.2.b, test method ASTM-C-794, applied separately to the window and seat materials.

a. The retaining ring or clips acting upon the internal surface of a glass window with cast-in-place bearing pads shall be structurally adequate to restrain the window against lateral or axial displacement under (1) vibration with 60 Hz frequency and 0.06 inch single amplitude, and (2) external impact loading.

b. Since the cast-in-place bearing pad is bonded to both the window and the window seat, the retaining ring does not have to exert a clamping force upon the bearing pad in order to prevent the window from axial or lateral displacement. If the designer chooses to precompress the bearing pads, the

clamping force shall (1) generate in the bearing pad an average compressive stress ≤ 500 psi and (2) be applied only after the bearing pad material has cured completely and is exhibiting elastomeric properties.

8.5.4 An annular space shall be provided between the edge of the plane window and the wall of the enclosure to allow for differential thermal expansion rates of window assembly components. The width of the annular space shall be a minimum of 0.125 inches at 300°F ambient temperature.

8.5.5 An annular space shall be provided between the inner surface of a cylindrical window and the metallic components of the seat in the enclosure. For most mounting configurations the clearances must meet the flame path requirements of Chapter 3.

8.5.6 Seats on cylindrical enclosures must be designed to withstand the internal design pressure without consideration of the pressure carried by the glass tube. Use the procedure of Figure 8.6.

8.5.7 All lenses with an area greater than 8 in² shall be protected from impact as specified by MSHA [1]. All window guards should be designed for a uniformly distributed loading which is equal to or greater than 300 psi and the mesh shall prevent penetration by objects with cross-sectional dimensions greater than 1 inch. Design flat mesh window guards according to the procedures in Figure 8.27.

8.6 Sealing of Glass Windows

8.6.1 Although preformed bearing gaskets, clamped between the glass window and the metallic seat, act also as seals, their function can be augmented by:

- a. dams, formed by injecting elastomeric compounds into the annular space between the window and metallic components of the seat assembly.
- b. O-rings, compressed radially or axially.
- c. packings, compressed radially and axially.

8.6.2 Neither the cast-in-place dams, nor the O-ring seals shall be utilized in the window assembly to restrain any of its components against forces exerted by the internal pressure nor as part of the flame path. Typical arrangements for the sealing of glass windows under internal pressure with elastomeric dams and O-rings are shown in Figures 8.8, 8.12 through 8.14 and 8.20.

a. The cast-in-place elastomeric dam shall have a minimum thickness of 0.125 inches to allow for placement of highly viscous elastomeric compounds into the annular space provided for it.

b. To insure satisfactory performance of the cast-in-place elastomeric dam, the surfaces of the annular cavity contacting the dam shall be cleaned and coated with a primer recommended by the elastomeric manufacturer to maximize adhesion of the elastomeric dam to the surfaces of the annular cavity.

c. The cast-in-place dam shall be manufactured from any of the elastomers qualified for this service. Elastomeric compounds that have been qualified for this service are given in Chapter 13.

d. The cast-in place dam shall have only a minimum of gas inclusions to minimize the rate of leakage of pressurized gas from the interior of the enclosure.

8.6.3 The elastomeric O-rings serving as seals in cylindrical window assemblies shall have a nominal thickness of ≥ 0.125 inches.

a. The components of the cylindrical window assembly shall be configured to precompress the O-ring seals a minimum of 0.020 inches regardless of dimensional tolerances on individual window seat assembly components.

b. The cylindrical surfaces contacting the O-ring seal shall have a surface finish of 63 rms or finer.

c. The annular clearance between the components of the cylindrical window assembly sealed by radially compressed O-rings shall meet the requirements of Chapter 3 if they form part of the flame path. Otherwise the annular clearance shall not exceed 0.010 inches at design temperature while the length of the same annular clearance shall exceed 0.75 inches.

d. The O-rings serving as seals in explosion proof enclosures shall be manufactured from elastomers qualified for sustained 300°F service and 100 percent RH environment.

8.6.4 The packings serving as seals in cylindrical window assemblies shall be manufactured from any of the materials qualified for sustained 300°F service in 100 percent RH environment.

a. The annular clearance between components of a cylindrical seat assembly sealed by a packing seal shall not exceed 0.030 inches radially.

b. The cylindrical surfaces contacting the packing seal shall have a surface finish of 63 rms or finer.

8.7 Fabrication of Glass Windows

8.7.1 Glass windows shall be fabricated only from glass compositions satisfying the requirements of Chapter 13.

8.7.2 The windows may be fabricated by any acceptable commercial technique. Typical techniques are (1) cutting and grinding from plate stock, or (2) pressing and grinding.

8.7.3 The high and low pressure faces of the windows, except for the bearing surface shall be polished, free of scratches and pits. The surfaces of molds used for molding shall have their surfaces polished.

a. The bearing surfaces on plane, cylindrical, and dome windows must be flat within 0.010 inches. Ground surfaces shall be finished with 220 micron or finer abrasive powder.

b. The ground bearing surfaces on a pressed plane window shall be located above the polished surface of the window to minimize the stress riser at the boundary line between the ground and polished surfaces.

8.7.4 The edges of plane windows shall be either ground, or cut and swiped.

8.7.5 All sharp corners shall be chamfered and free of chips exceeding 0.020 inches in size.

8.7.6 After grinding and polishing, the windows shall be subjected to a thermal treatment.

a. The thermal treatment for windows designed to serve in the annealed state shall consist of subjecting them to the appropriate annealing procedure for that glass composition. The annealing procedure shall be capable of decreasing the residual stress in the window below 600 psi.

b. The thermal treatment for windows designed to serve in the tempered state shall consist of subjecting them to the appropriate thermal tempering treatment for that glass composition. The selected tempering procedure shall generate residual compressive stresses whose magnitude on the surface of the window shall exceed 4000 psi.

c. The thermal treatments utilized in annealing or tempering of glass windows shall be qualified prior to initiation of production run.

d. The qualification of thermal treatment shall consist of thermally treating at least three windows according to proposed temperature and time schedule and subsequently measuring the magnitude of residual stresses in the window. If the magnitude of residual stresses in the treated windows falls within the scope of 8.7.6.a or 8.7.6.b, the thermal treatment shall be considered qualified for the particular window design.

8.8 Geometries of Plastic Windows

8.8.1 Plastic windows shall have one of the standard geometries shown in Figures 8.1, 8.5, 8.7 and 8.17.

8.8.2 Windows with other geometries may be utilized in explosion-proof enclosures providing that the nonstandard geometry is first qualified by design procedure of 8.8.3 and tests of 8.8.4.

8.8.3 a. The window of nonstandard geometry shall be designed for 150 psig design pressure. The nominal stress value used in the design shall be based on the maximum design temperature allowed for the selected material. The nominal stress values recommended by this guide for different design temperatures and plastic materials are given in Chapter 13.

b. The test fixture shall be designed to retain and seal the window against 300 psig internal pressure without permanent deformation of the fixture. The mounting and sealing of the window shall satisfy sections 8.8 and 8.9 of this Guide.

c. A minimum of one test fixture and four windows shall be procured for the qualification tests.

d. The windows shall be successively mounted in the test fixture and subjected individually to qualification tests of 8.6.4.

8.8.4 The qualification test shall consist of the following:

a. Pressurizing the interior of the test fixture to 300 psig with gas or fluid and maintaining this pressure for 1 hour without leaking, cracking, crazing, or permanent deformation in excess of 0.2 percent. The internal surface of the window shall be maintained during the duration of the pressure test at the maximum design temperature recommended in this guide for the material from which the window is fabricated.

b. Submerging for one minute the mounted window at design temperature in water at 59°F without observable cracking or crazing.

c. Impacting the window at its center with a steel striker. The 4.0 lb striker is equipped with a 1 inch diameter hemispherical impacting surface. The striker shall be dropped from the elevation specified in Chapter 3. After impact testing, the window shall be subjected to thermal shock testing per 8.6.4b, followed by internal pressurization to 300 psig at room temperature. These series of tests are to be performed successively on three windows. If any of the windows leak, crack, craze or distort permanently more than 0.2% during these tests, the design of the window assembly shall be modified as required to meet the design requirements.

8.9 Design of Plastic Windows

8.9.1 The thickness of a window with standard geometry shall be based primarily on the design pressure and temperature, and only secondarily on the design impact resistance.

8.9.2 The design pressure of the window shall be determined by the procedures of Chapter 4.

8.9.3 The calculated value of maximum nominal tensile and compressive stress in the window at design pressure shall not exceed the design stress values for the selected plastic material composition and design temperature. The design stress values recommended by this guide for plastic windows at different design temperatures are given in Chapter 13.

8.9.4 The maximum nominal tensile or compressive stress in the window shall be calculated for standard window geometries shown in Figures 8.1, 8.5, 8.7, and 8.17 with the aid of expressions shown in Figures 8.2, 8.3, 8.4, 8.6 and 8.18. For plane windows shown in Figure 8.1, the proper edge condition coefficient must be selected. Free edge condition shall be applied to windows sandwiched between elastomeric gaskets or cast-in-place bearing pads (i.e. neoprene, rubber, silicon rubber, etc.), while the fixed edge condition shall be applied to windows sandwiched between nonelastomeric gaskets such as lead or asbestos, bearing directly on the metallic surfaces of the seat in the enclosure, or bonded in place with epoxy. The maximum nominal stress in the dome windows of Figure 8.7 shall be calculated with the expression of Figure 8.6 for cylindrical windows.

These expressions neglect stresses generated by (a) differential thermal expansion between window and enclosure, (b) elastic deformation of the

enclosure, (c) edge conditions and (d) stress riser in the form of sharp corners. For this reason, the actual peak stress in the window may exceed the nominal tensile design stress by as much as 200%. This is, however, acceptable as the nominal design stress of 8.9.3 is sufficiently below the ultimate strength of plastic to allow for the presence of peak stresses whose value exceeds the nominal design stress by approximately 300 percent.

8.9.5 If the magnitude of the temperature of the interior surface of the window mounted in the enclosure is known from past experience or analytical calculations, the design of the window shall follow the procedure outlined in 8.9.2 through 8.9.4.

8.9.6 If the window surface temperature is not known to the designer, he shall (a) design the window on the basis of the maximum allowable design temperature for the plastic material as given in Chapter 13 and (b) experimentally confirm the design values according to 8.9.7.

8.9.7 The experimental confirmation of the design temperatures shall be performed on an operational enclosure dedicated to the selected window design. The evaluation shall consist of:

a. Perform an operational test by turning on the lamp or other heat generating equipment inside the enclosure and record the temperature on the interior surface of the window after eight hours of continuous operation.

b. Compare the experimentally obtained window temperature values to the design value. If the recorded surface temperatures are below or equal to the maximum allowable design temperature, the design is considered to be acceptable.

c. If the surface temperature exceed the design value of 8.9.6, the design is considered unacceptable and the design validation procedures 8.9.7.a and 8.9.7.b must be repeated after the enclosure or internal equipment have been modified.

8.9.8 Each new window assembly design shall be experimentally validated prior to the start of production. The design validation program shall consist of subjecting the enclosure with the new window assembly to the whole series of tests specified in 8.9.3.

8.10 Mounting of Plastic Windows

8.10.1 The window may be mounted in an enclosure, or in a removable cover mechanically fastened to the enclosure.

8.10.2 The window shall be restrained against internal design pressure and vacuum by being securely clamped between the structural components of the enclosure. Typical designs for mounting of plane, cylindrical, dome or spherical windows are shown on Figures 8.8 through 8.16 and 8.19 through 8.21.

8.10.3 Plane windows shall extend a minimum of 0.5 inches past the inner edge of the metallic seat to provide adequate bearing surface for the window under design pressure.

8.10.4 a. The plane or inclined window seat on the enclosure or cover shall rotate less than 0.5 degree when the enclosure is internally pressurized to design pressure. The flanges of plane external window seats are to be designed according to Figure 8.23.

b. The flanges of internal window seats shall be designed to withstand external impact loads according to Figure 8.25.

c. Window seat flanges shall also be capable of withstanding precompression loads of 8.10.14 or 8.10.15. Design for precompression loads according to Figure 8.26.

d. The thickness of a hold-down flange shall not be less than 3/16 inches.

8.10.5 Direct contact between plastic and metallic seat surface is permitted as plastic deformation of the plastic will accommodate high points on the seat surface without initiation of cracks.

8.10.6 Material interposed between the plastic window and metallic seat surfaces may take the form of a preformed gasket bonded to the metallic seat, or of a cast-in-place bearing pad bonded to both the window and the seat.

8.10.7 The preformed gasket may be fabricated from any material meeting the requirements of Chapter 13. The gasket shall be formed either by (a) cutting a continuous strip of material from commercially available sheets of material or by (b) placing a uniformly thick layer of material on the surface of the metallic seat and curing it prior to mounting the window in the enclosure.

8.10.8 The peel strength of bond between the preformed gasket and the metallic seat shall exceed 20 lb/inch of gasket width. The peel strength shall be established by procedure 8.10.9.

8.10.9 The peel strength of bond between the preformed gasket and the seat material shall be determined by standard test methods ASTM-D-903 or C-794, depending on whether method 8.10.7(a) or 8.10.7(b), was used to fabricate the gasket. Both tests are to be conducted at 150°C on test specimens heat-aged at 150°C and 100 percent RH for 1000 hours.

8.10.10 The cast-in-place bearing pad shall consist of material meeting the requirements of Chapter 13. The strength of bond between the cast-in-place bearing pad material and both the plastic window and the metallic seat material shall meet the requirements of 8.10.8. The peel strength of bond shall be established by procedure 8.10.9, test method ASTM-C-794, applied separately to the window and seat materials.

8.10.11 The plane surfaces on the metallic components of the window seat contacting:

- a. the bare plastic window, or a plastic window protected by a non-elastomeric preformed basket shall be flat within 0.010 inches and shall have a finish of 32 rms or better.

- b. the plastic window protected by a preformed elastomeric gasket shall be flat within 0.020 inches and shall have a finish of 63 rms or better.

- c. the plastic window protected by cast-in-place bearing pads shall be flat within 0.030 inches and shall have a finish of 125 rms or better.

8.10.12 The inclined surfaces on the window seat contacting the inclined, bare bearing surfaces on the plastic window shall meet the following requirements:

- a. Bevel angle shall be in the range of $30 \leq \alpha \leq 45^\circ$

- b. Flat, within 0.010 inches

- c. Angular tolerance on the specified angle shall not exceed $+0^\circ 0' / -0^\circ 30'$.

8.10.13 The retaining ring for a plastic window with cast-in-place bearing pads shall meet the requirements of 8.10.4 for enclosure window seats.

8.10.14 Since the cast-in-place bearing pad is bonded to both the window and the window seat, the retaining ring does not have to exert a

clamping force upon the bearing pad in order to prevent the window from axial or lateral displacements. If the designer chooses to precompress the bearing pads, the clamping force shall (1) generate in the bearing pad an average compressive stress ≤ 500 psi; (2) it will be applied only after the bearing pad material has cured completely and is exhibiting elastomeric properties.

8.10.15 a. The clamping forces exerted by a hold-down ring on a window sandwiched between preformed gaskets and the metallic seat shall be adequate to restrain the window against lateral or axial displacement under vibration with 60 Hz frequency and 0.06 inch single amplitude. The average bearing stress in the preformed gasket generated by precompression shall not exceed 500 psi. In the calculation of the bearing stress it can be assumed that the clamping force exerted by the hold-down flange on the window is acting uniformly all around the window's circumference. The clamping force exerted by torquing down of bolts is given in Figure 8.22.

b. Windows with square edges mounted between two bare metal surfaces shall be precompressed to insure good contact between the plastic and the bare window seat. The precompression shall be generated by the retaining ring contacting the interior surface of the window. The magnitude of the forces shall be adequate to restrain the window against axial and lateral displacement under vibration with 60 Hz frequency and 0.06 inches single amplitude. The peak bearing stress under individual bolts, springs or the average bearing stress under multiple bolts shall not exceed 1000 psi.

c. Windows mounted between a bare metal surface and a metal surface protected by a preformed elastomeric gasket shall be precompressed by bolted or threaded retaining rings. The magnitude of forces exerted by the retaining ring shall be adequate to restrain the window against axial and lateral displacement under vibration with 60 Hz frequency and 0.060 inches single amplitude. The average bearing stress in the preformed gasket generated by precompression shall not exceed 500 psi.

8.10.16 a. The spacing of bolts around the circumference of the hold-down flange shall not exceed 3 inches.

b. The bolts shall be structurally adequate to withstand the forces generated by (1) precompression of the gasket and (2) internal design pressure, or external impact loading, depending on whether the hold-down ring is acting upon the internal or external surface of the window.

8.10.17 a. Because of the large difference in thermal coefficients of expansion between plastics and metals, provision must be made in the seat design to accommodate the dimensional changes in plastic windows.

b. For plane windows with square edges, this is accomplished by making the window diameter or length and width undersized in respect to the seat cavity in the enclosure. The allowance for window expansion is a function of plastic composition, enclosure material, window dimensions, and design temperature. The minimum value of the clearance for thermal expansion is based on the avoidance of contact between the edges of the window and the walls of the window seat cavity at temperatures equal to or lower than design temperature. If a cast-in-place seal is used around the circumference of the window the maximum value of thermal expansion should be no more than one-half of the room temperature thickness of the seal.

c. Plane and spherical windows with inclined edges mounted on inclined seats do not require annular clearance to accommodate thermal expansion of the window as the conical surfaces transform the lateral expansion of the plastic into an axial movement of the whole window. The axial movement of the window must be compensated for by interposing an elastomeric gasket or O-ring between the interior window surface and the retaining ring.

8.10.18 All lenses with an area of 8 in² or greater shall be protected from impact as specified by MSHA [1]. All window guards should be designed for a uniformly distributed loading which is equal to or greater than 300 psi and the mesh shall prevent penetration by objects with cross-sectional dimensions greater than 1 inch. Design flat mesh window guards according to the procedures in Figure 8.27.

8.11 Sealing of Plastic Windows

8.11.1 Although preformed bearing gaskets clamped between the plastic window and the metallic seat act also as seals, their sealing function may be augmented by:

- (a) dams, formed by injecting elastomeric compounds into the annular space between the window and metallic components of the seat assembly.
- (b) O-rings, compressed radially, or axially.
- (c) packings, compressed radially and axially.

- (d) wedging action between the inclined bearing surface on the window and its mating seat.

8.11.2 Neither the cast-in-place dams, nor the O-ring seals shall be utilized in the window assembly to restrain any of its components against forces exerted by internal pressure nor as part of the flame path. Typical arrangements for sealing of plastic windows under internal pressure are shown in Figures 8.8 through 8.16 and 8.19 through 8.21.

a. The cast-in-place elastomeric dam shall have a minimum thickness of 0.125 inches to allow for placement of highly viscous elastomeric components into the annular space provided for it.

b. To insure satisfactory performance of the cast-in-place elastomeric dam, the surfaces of the annular cavity contacting the dam shall be cleaned and coated with a primer recommended by the elastomeric manufacturer to maximize adhesion of the elastomeric dam to the surfaces of the annular cavity (i.e. surface of window and metallic seat).

c. The cast-in-place dam shall be manufactured from any of the elastomers qualified for this service. The qualification procedure and the elastomeric compounds that have been qualified for this service are given in Chapter 13.

d. The cast-in-place dam shall have only a minimum of gas inclusions to minimize the rate of leakage of pressurized gas from the interior of the enclosure.

8.11.3 a. The elastomeric O-rings serving as:

(1) radially compressed seals in cylindrical window assemblies shall have a nominal diameter $\geq$ 0.125 inches;

(2) axially compressed seals in plane seats for plane windows with square edges shall have a nominal diameter $\geq$ 0.125 inches

(3) wedged seals around the circumference of high pressure faces on plane, spherical or dome windows shall have a nominal diameter $\geq$ of 0.25 inches.

b. The components of the window assemblies shall be configured to precompress the O-ring seal a minimum of 0.020 inches regardless of dimensional tolerances on individual window seat assembly components.

c. The surfaces on the components of window assemblies in contact with O-rings shall have a surface finish of 63 rms or finer.

d. The annular clearance between the components of the cylindrical window assembly sealed by radially compressed O-rings shall satisfy the flame path requirements of Chapter 3 if it is part of the flame path. Otherwise, the angular clearance shall not exceed 0.010 inches radially at design temperature, while the length of the same annular clearance shall not be less than 0.75 inches.

e. The annular clearance between the square edge of a plane window and the wall of the seat cavity sealed by a wedged O-ring shall not exceed 0.020 inches at design temperature.

f. The O-rings serving as seals in explosion-proof enclosures shall be manufactured from elastomers qualified for this service. The elastomeric compounds that have been qualified for this service are given in Chapter 13.

8.12 Fabrication of Plastic Windows

8.12.1 Plastic windows shall be fabricated only from materials satisfying the requirements of Chapter 13.

8.12.2 The windows may be fabricated by (1) machining from plate or bar stock, (2) modeling, or (3) extruding. The molded and extruded windows may require some machining to bring them in conformance with specified dimensions and bearing surface finishes.

8.12.3 The high and low pressure faces of windows shall have a finish of 32 rms or finer.

8.12.4 During the fabrication process, substances and fluids detrimental to plastics shall not be allowed to come in contact with the window surfaces.

8.12.5 The plastic windows shall be annealed once, and in some cases twice, prior to installation in the enclosure.

a. Windows fabricated by molding or extrusion must be annealed at least once, when all the manufacturing operations have been completed.

b. The annealing procedure must follow the recommendations of the plastic supplier, however the annealing temperature must exceed the maximum design temperature of the given plastic by at least 10°F.

8.12.6 a. All dimensions on the finished window shall be checked for conformance to the drawings.

b. Dimensions of finished plane windows with square edges shall be within ± 0.032 inches of nominal dimensions.

c. The major diameter (or width and height) of finished plane and spherical windows with inclined bearing surfaces shall be within ± 0.020 inches of nominal dimensions. The thickness of finished windows shall be within ± 0.032 inches of specified nominal thickness. The angle of the inclined bearing surface shall be within $+ 0^{\circ}30' / -0^{\circ}00'$ of the specified nominal angle.

d. The diameter and wall thickness of cylindrical windows shall be within ± 0.032 inches of specified nominal dimensions.

8.13 Quality Assurance

8.13.1 The fabricator of explosion proof enclosures with windows shall establish a quality assurance program for all components of the enclosure to insure satisfactory performance of the enclosure at design pressure and temperature.

8.13.2 The quality assurance program shall consist as a minimum of the following elements:

a. Visual and dimensional inspection of each window for conformance to drawings and specifications, and review of associated source certificates for conformance to 8.1 and 8.2.

b. Visual and dimensional inspection of each window seat component prior to assembly for conformance to drawings and specifications, and review of material documentation.

c. Visual inspection of each completed enclosure for conformance to requirements of this Guide.

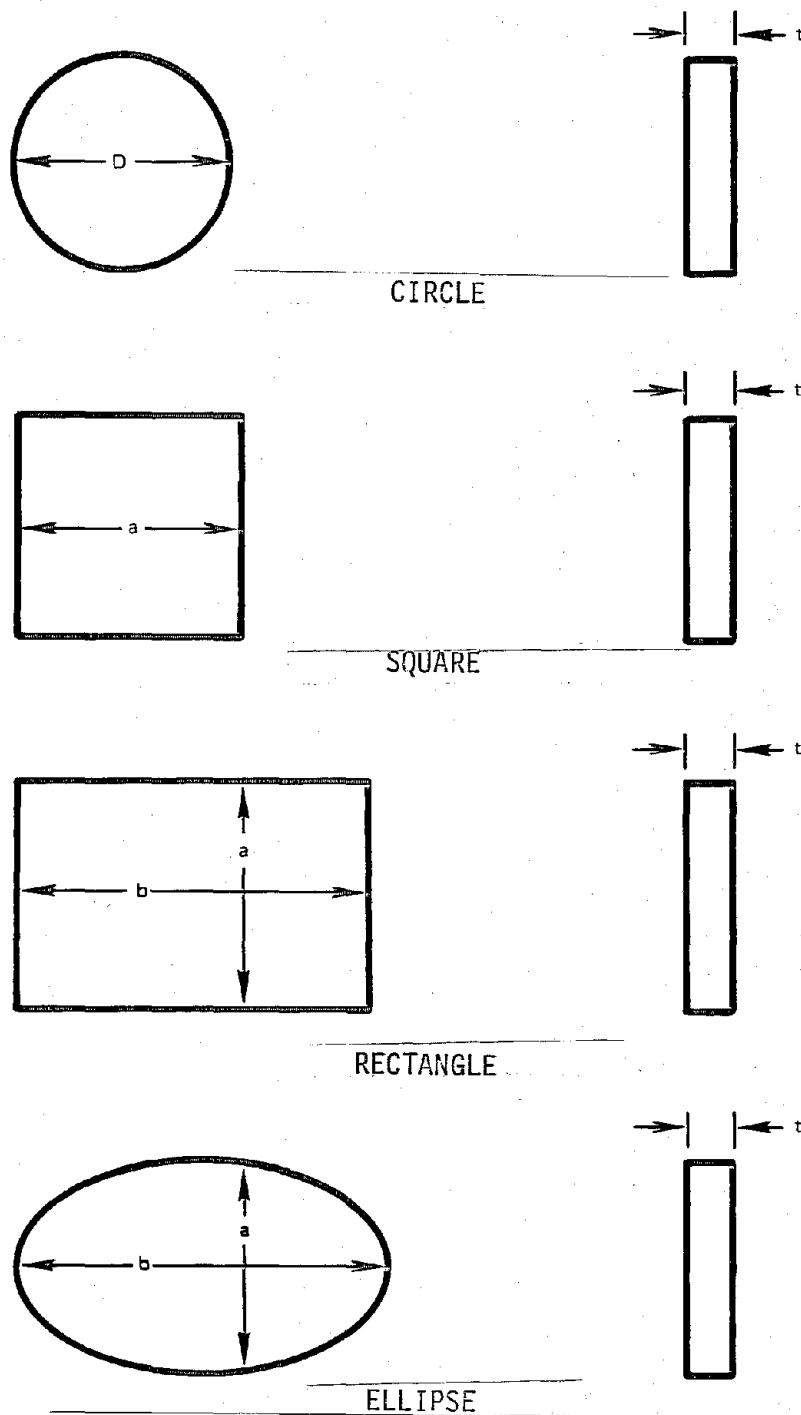


Figure 8.1. Standard Plane Window Geometries

CIRCULAR WINDOW

$$\sigma_m = k_1 (D_i/t)^2 p \quad p = \text{pressure, psi}$$

EDGE FREE; $k_1 = 0.3025$

EDGE CLAMPED; $k_1 = 0.1875$

SQUARE WINDOW

$$\sigma_m = k_2 (a/t)^2 p \quad p = \text{pressure, psi}$$

EDGES FREE; $k_2 = 0.287$

EDGES CLAMPED; $k_2 = 0.308$

RECTANGULAR WINDOW

$$\sigma_m = k_3 (a/t)^2 p \quad p = \text{pressure, psi}$$

EDGES FREE; $k_3 = \text{Curve A, Figure 3}$

EDGES CLAMPED; $k_3 = \text{Curve B, Figure 3}$

ELLIPTICAL WINDOW

$$\sigma_m = k_4 (a/t)^2 p \quad p = \text{pressure, psi}$$

EDGES FREE; $k_4 = \text{Curve A, Figure 4}$

EDGES CLAMPED; $k_4 = \text{Curve B, Figure 4}$

Figure 8.2. Maximum Bending Stresses In Plane Windows

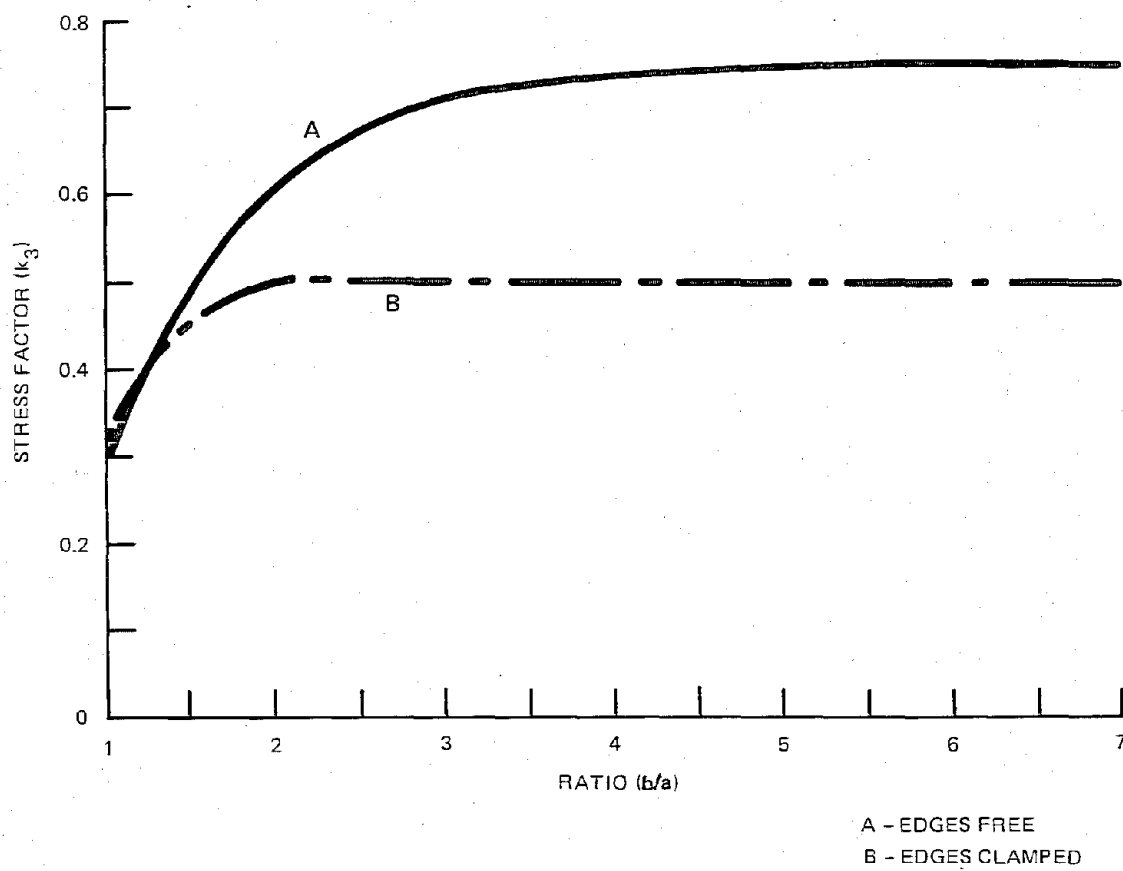


Figure 8.3. Stress Factors For Rectangular Windows Under Uniform Pressure

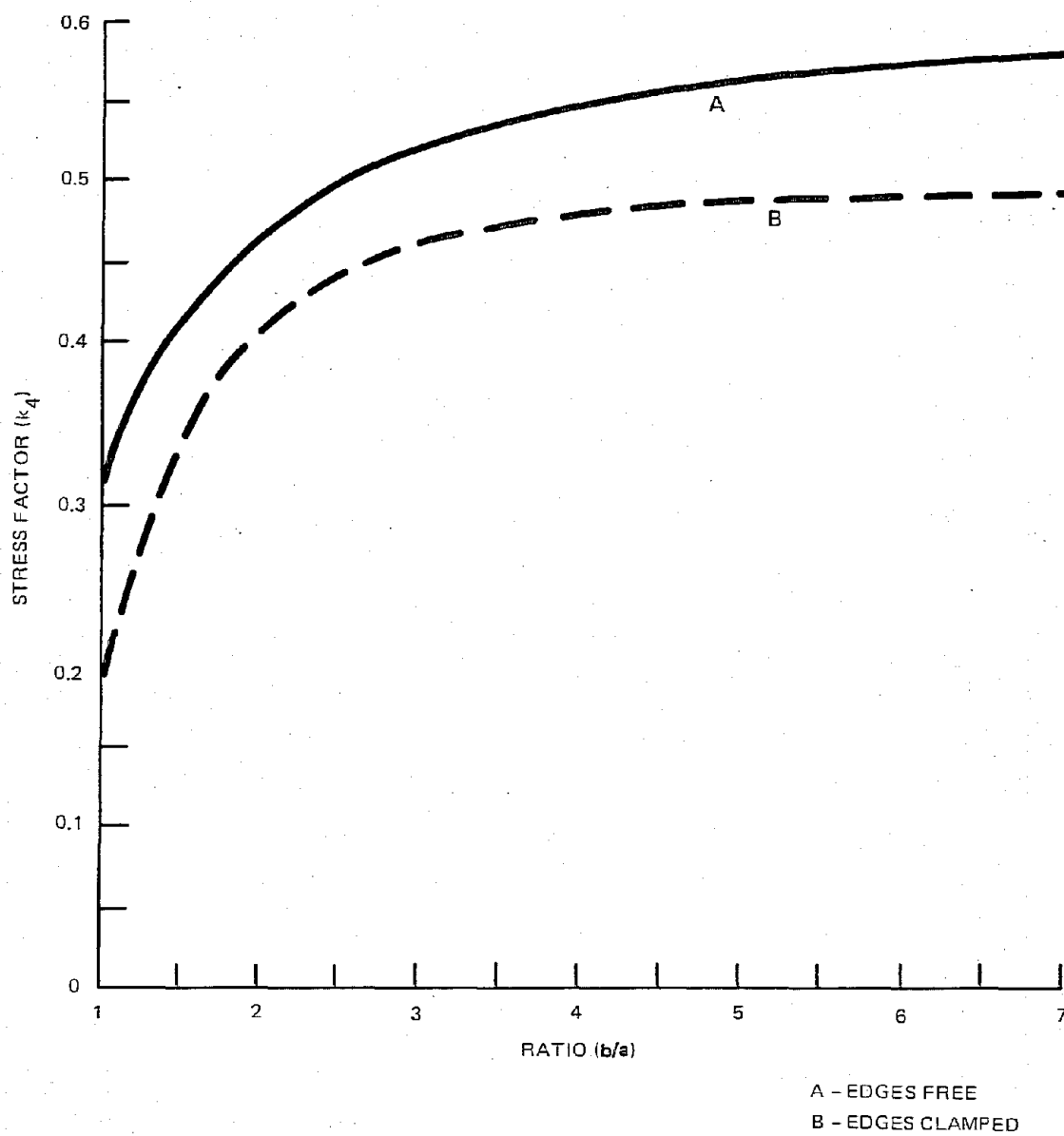


Figure 8.4. Stress Factors For Elliptical Windows Under Uniform Pressure

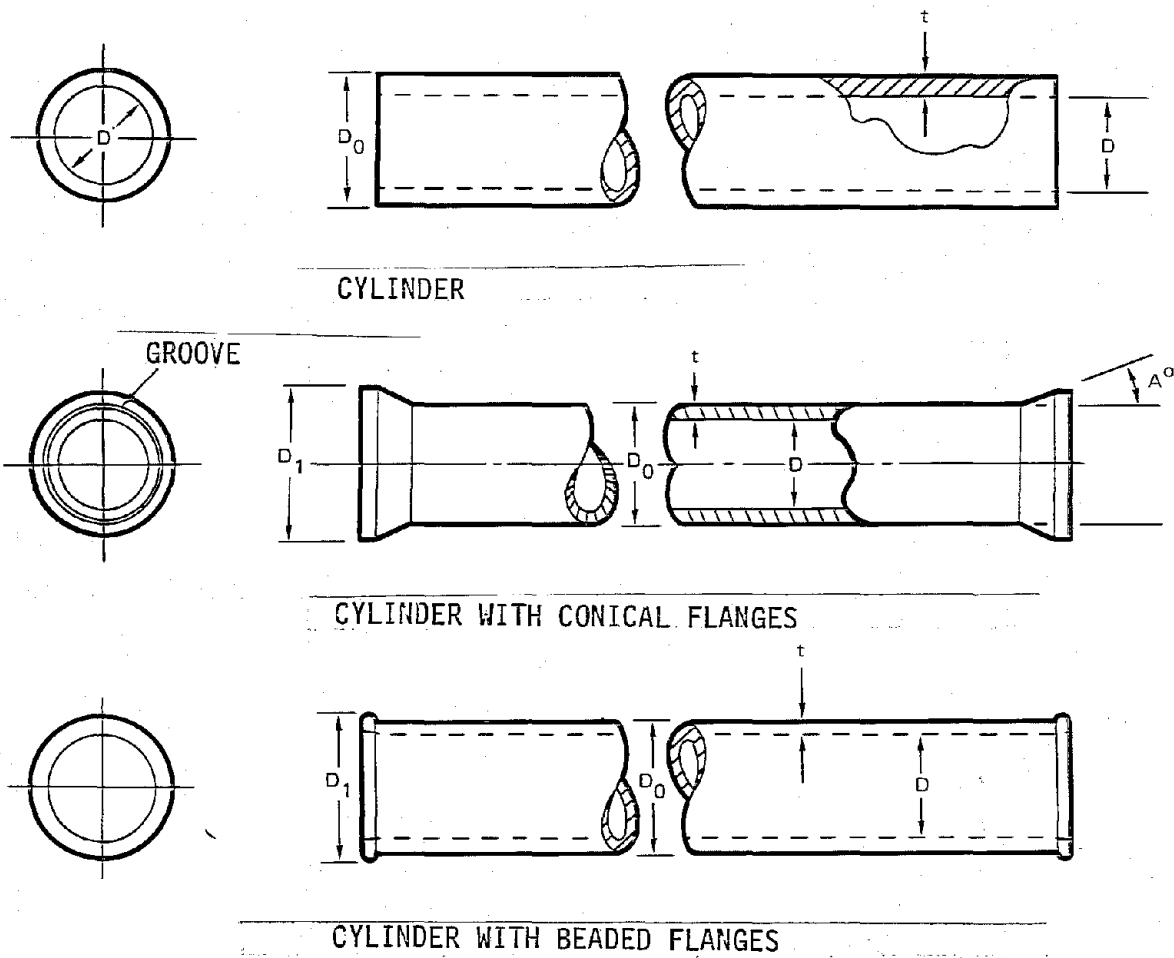


Figure 8.5. Standard Cylindrical Window Geometries

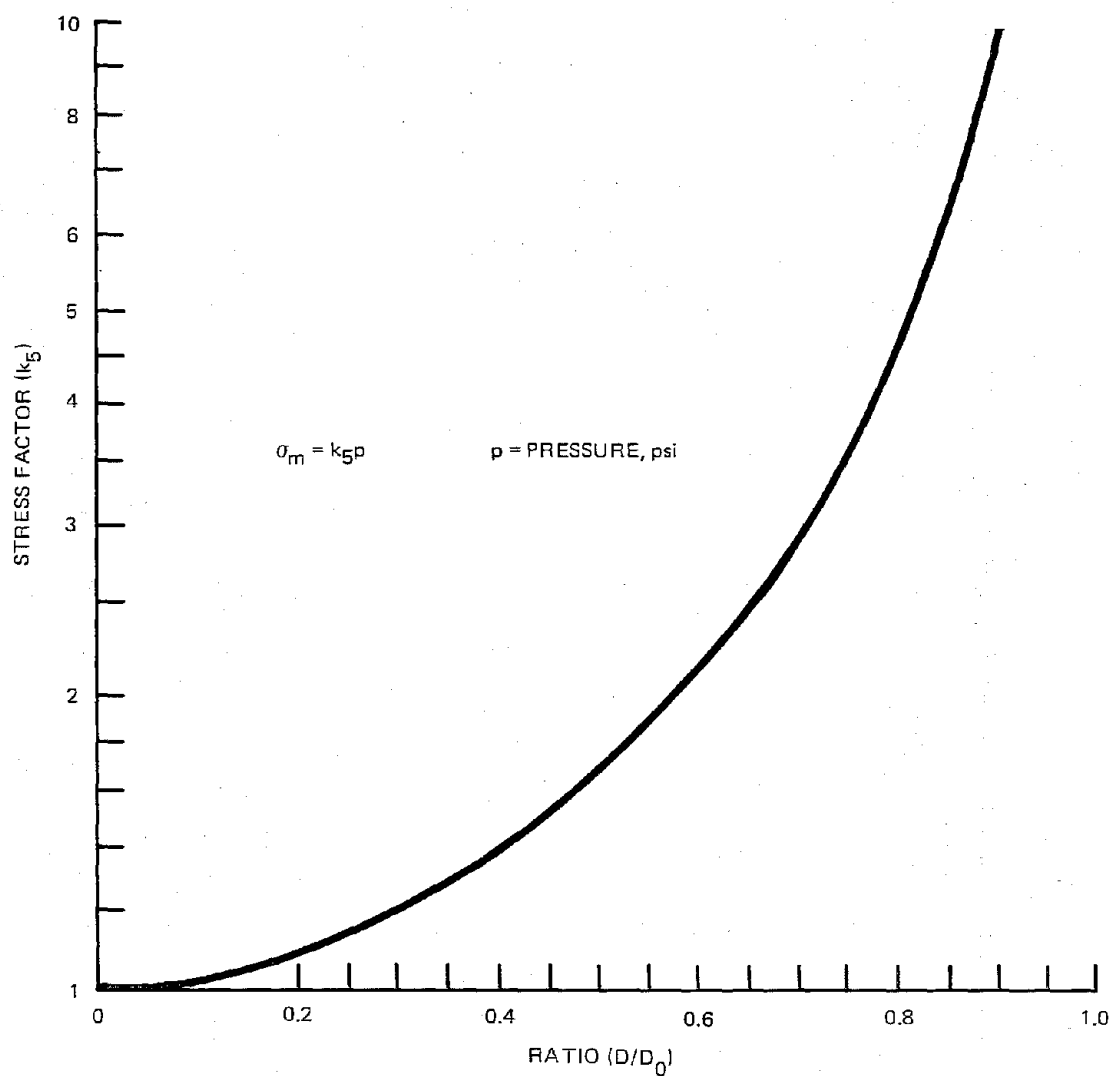


Figure 8.6. Maximum Hoop Stress in Cylindrical Windows

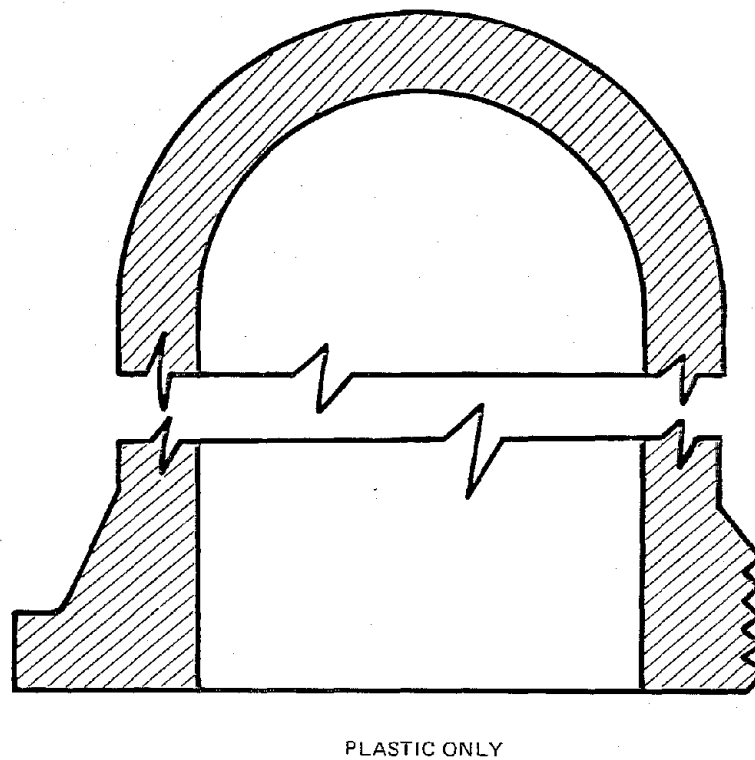
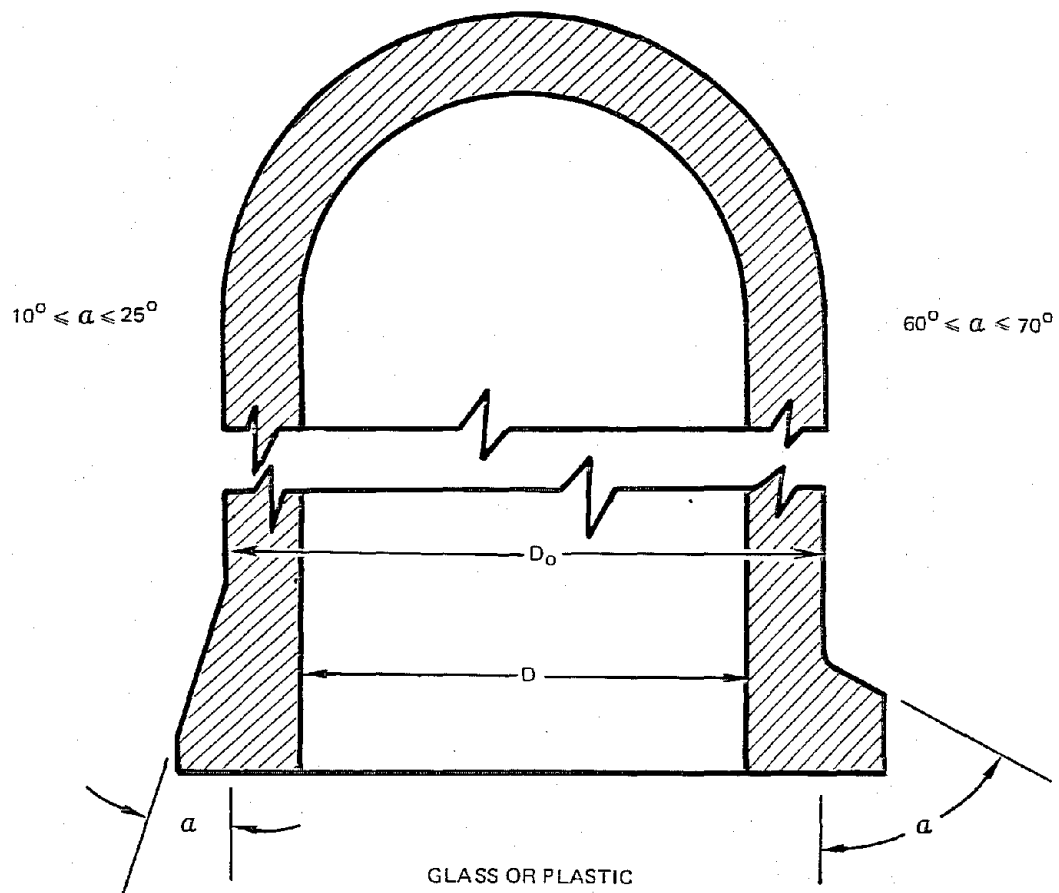
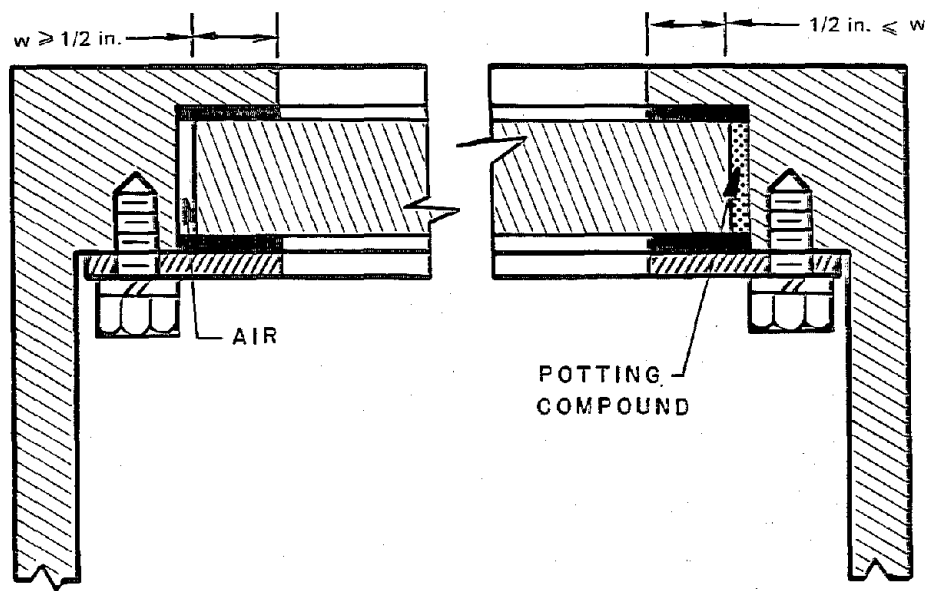
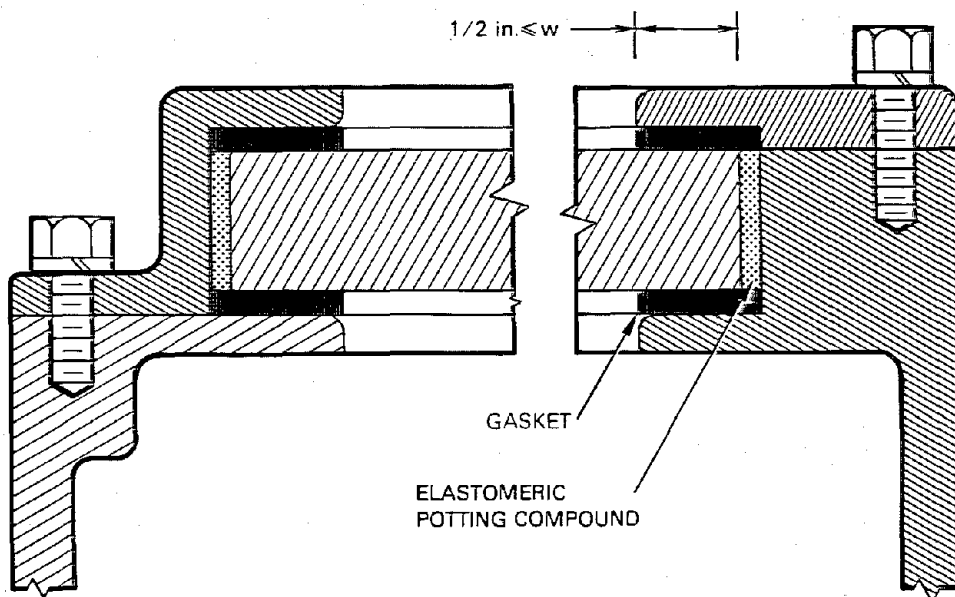


Figure 8.7. Standard dome window geometries

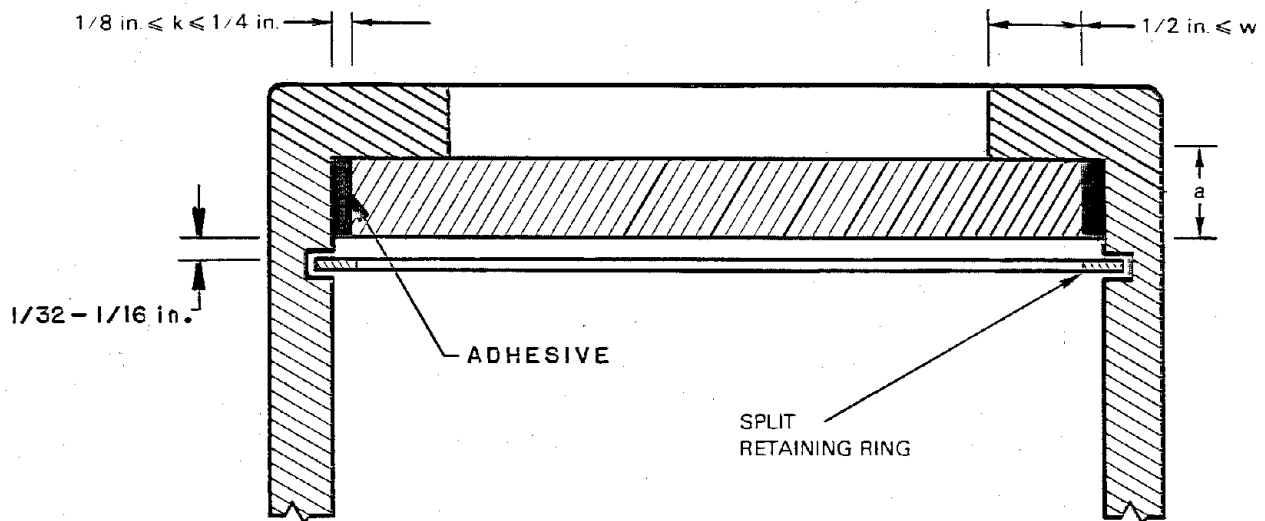


(a)

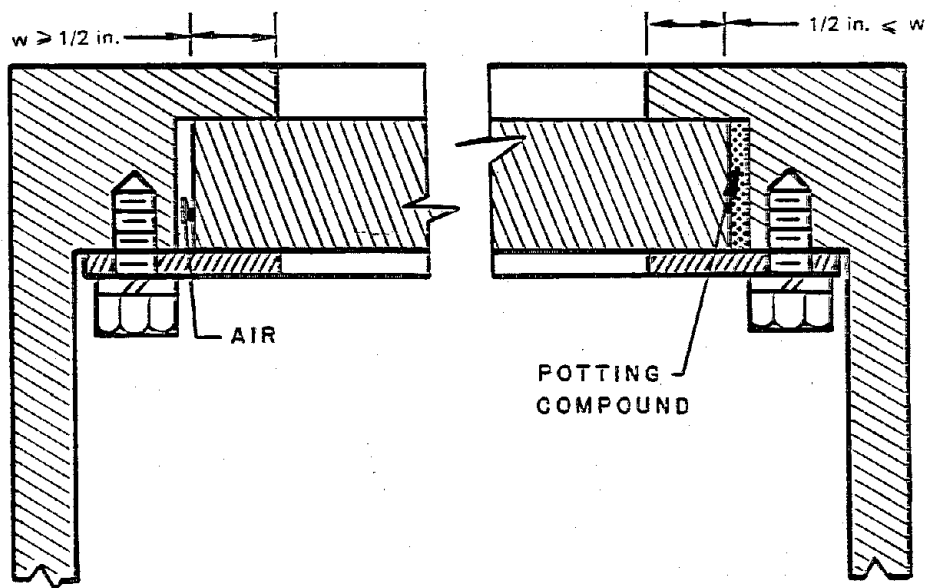


(b)

Figure 8.8. Typical Mounting and Sealing Arrangements for Plane Glass or Plastic Windows



(a)



(b)

Figure 8.9. Typical Mounting and Sealing Arrangements for Plane Plastic Windows

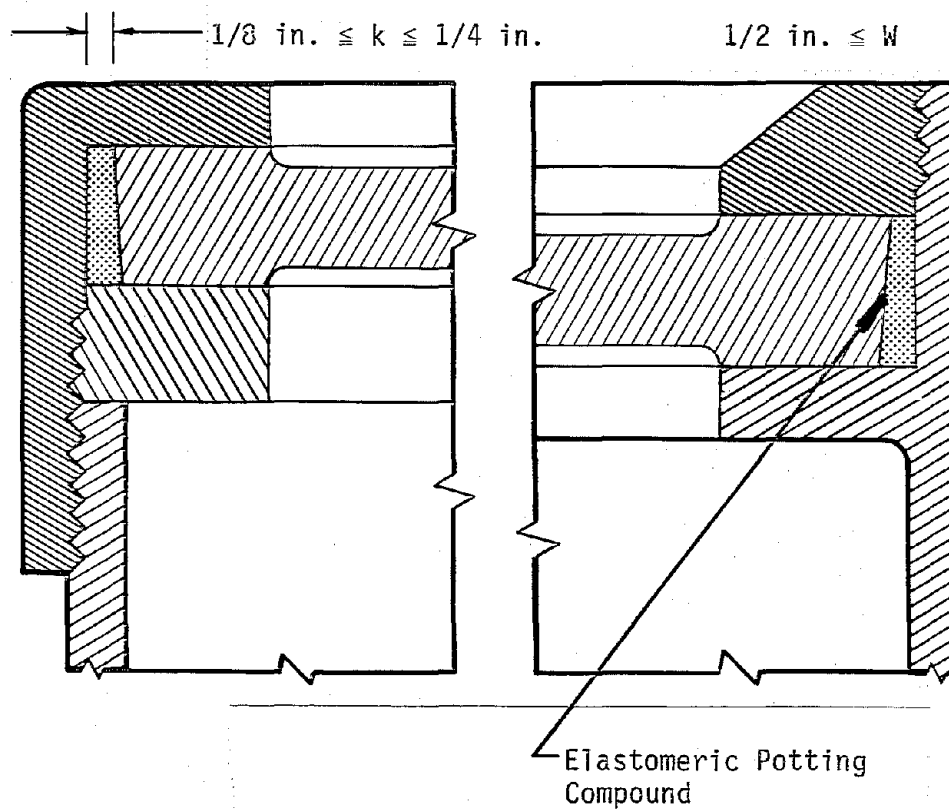


Figure 8.10. Typical Mounting and Sealing Arrangements for Plane Plastic Windows

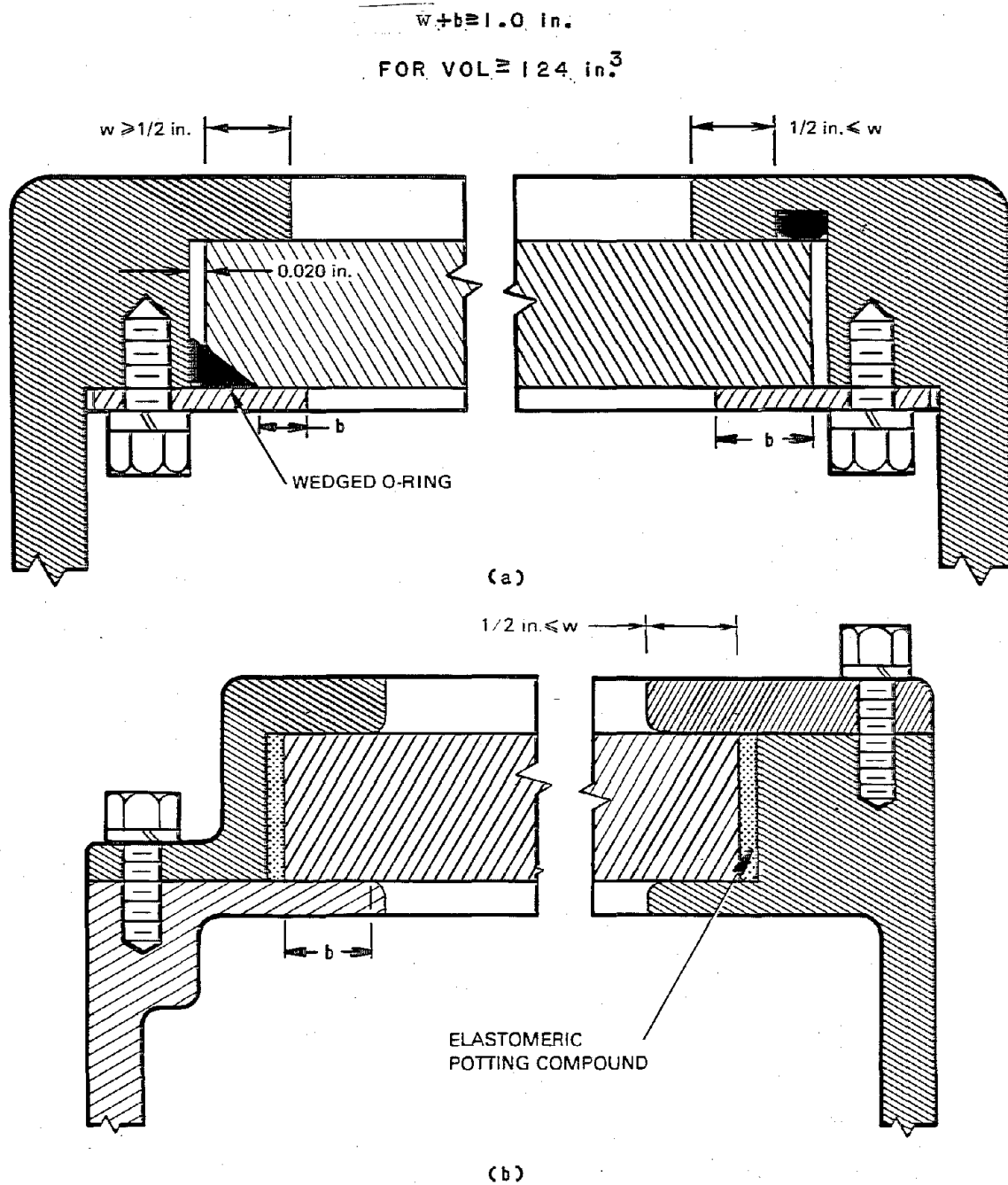
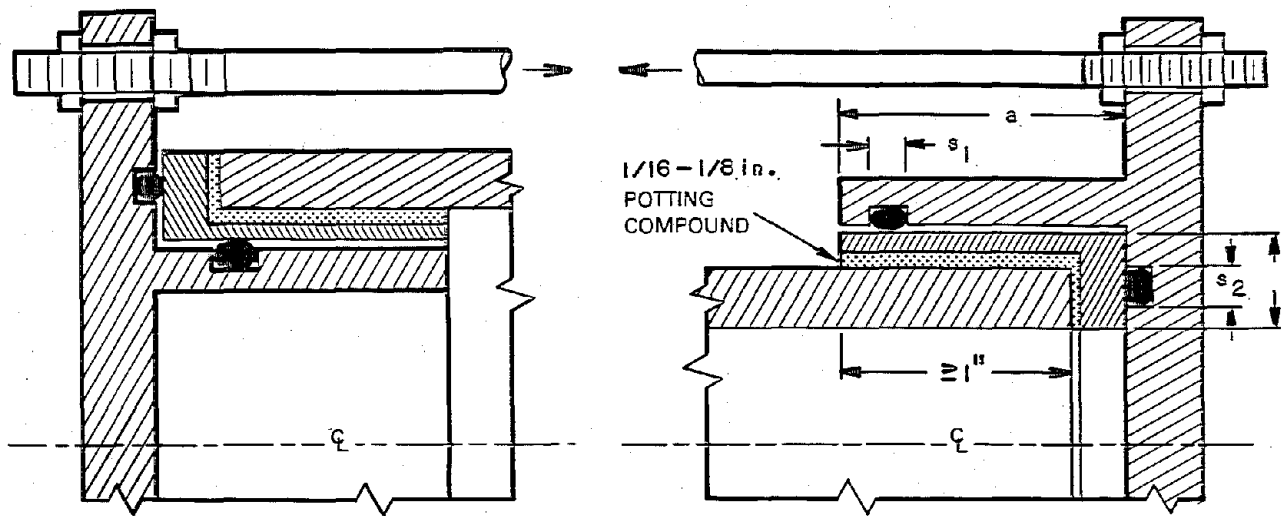
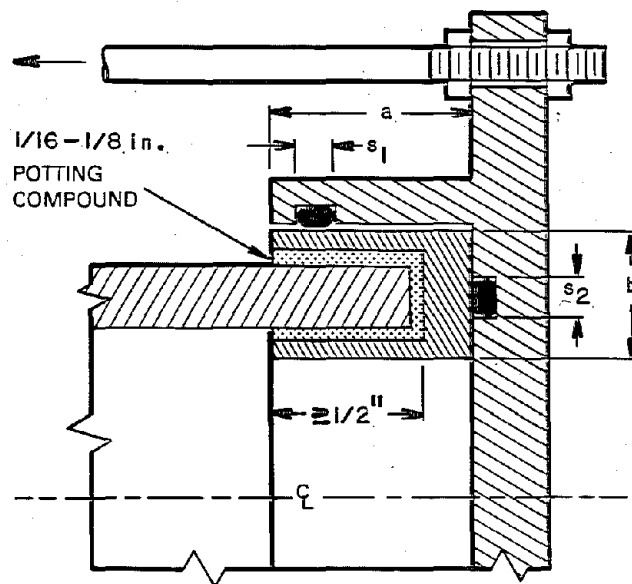


Figure 8.11. Typical Mounting and Sealing Arrangements for Plane Plastic Windows

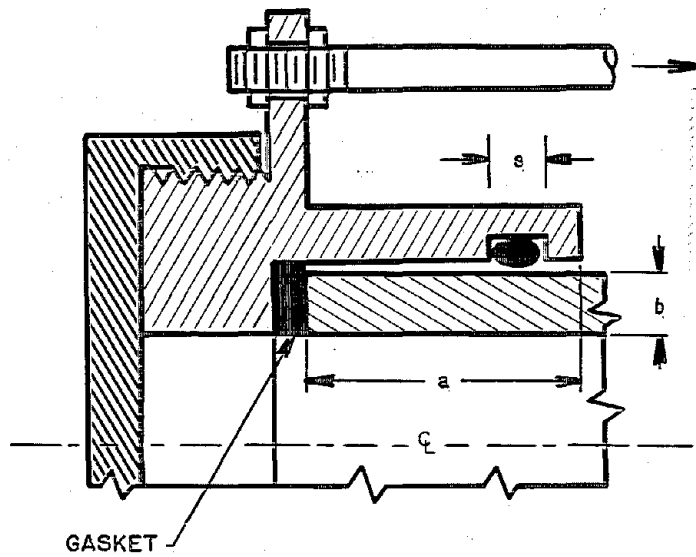


(a)

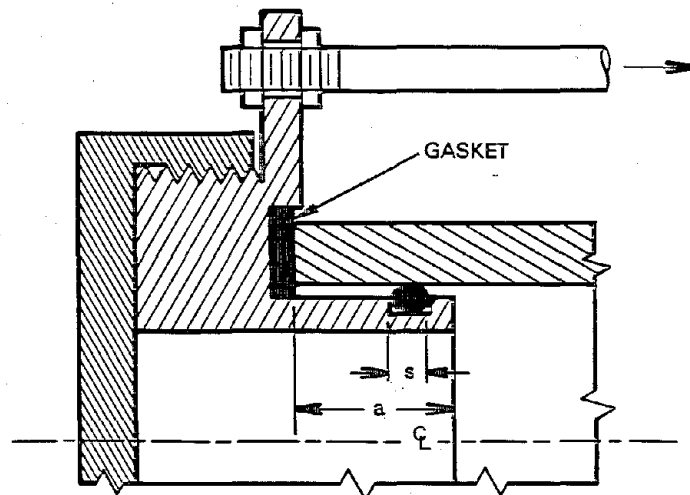


(b)

Figure 8.12. Typical Mounting and Sealing Arrangements for Glass or Plastic Tubes



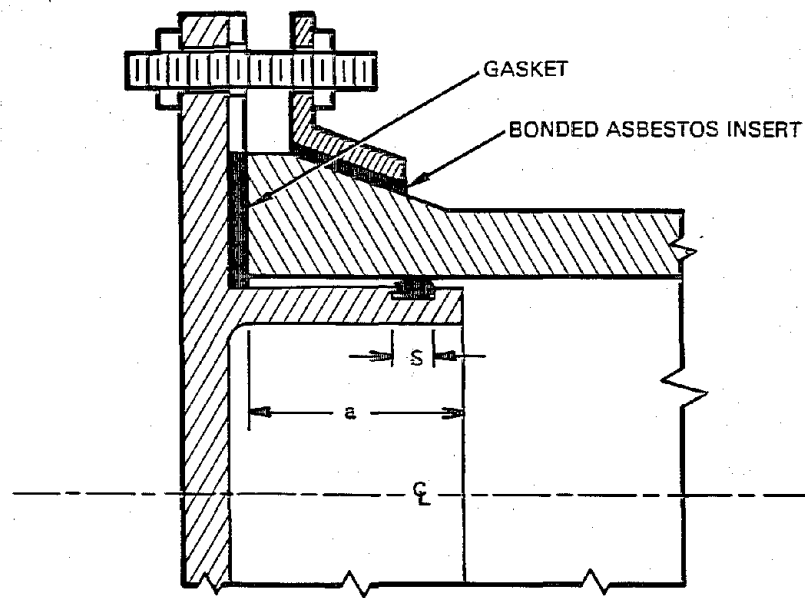
(a)



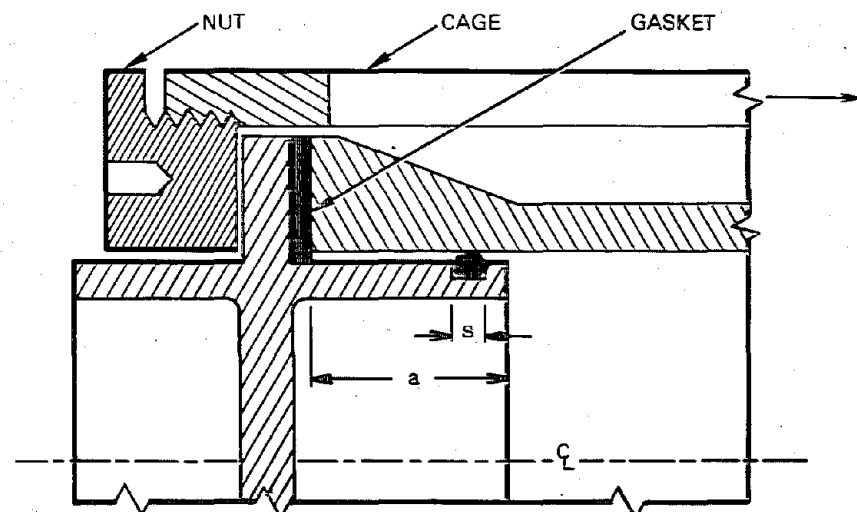
$a-s \geq 1.0 \text{ in}$
FOR VOL $\geq 124 \text{ in}^3$

(b)

Figure 8.13. Typical Mounting and Sealing Arrangements for Glass or Plastic Tubes



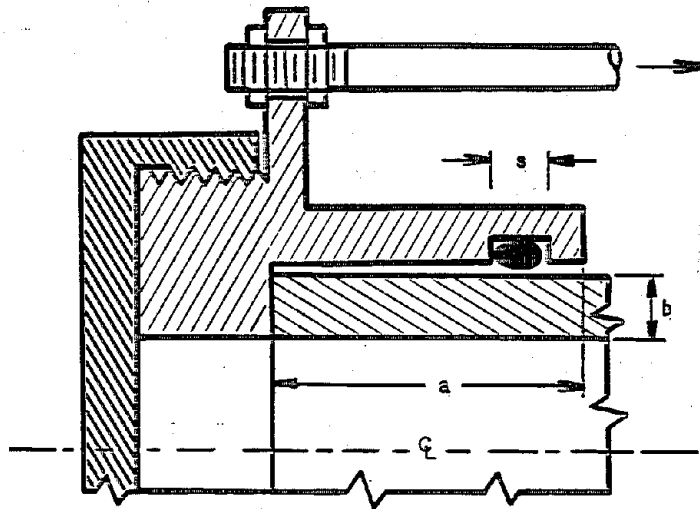
(a)



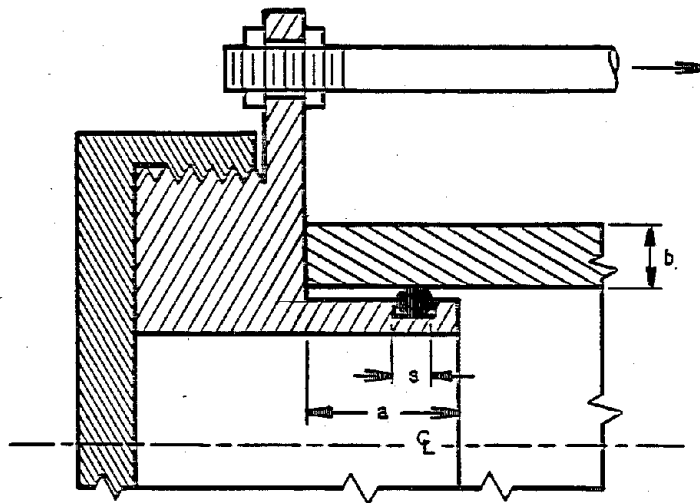
(b)

$a-s \geq 1.0 \text{ in}$
FOR VOL $\geq 124 \text{ in}^3$

Figure 8.14. Typical Mounting and Sealing Arrangements for Glass or Plastic Tubes



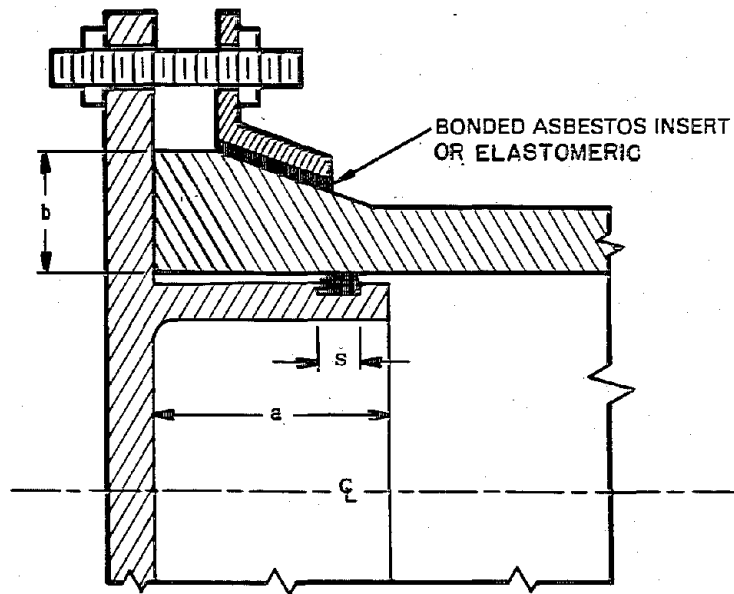
(a)



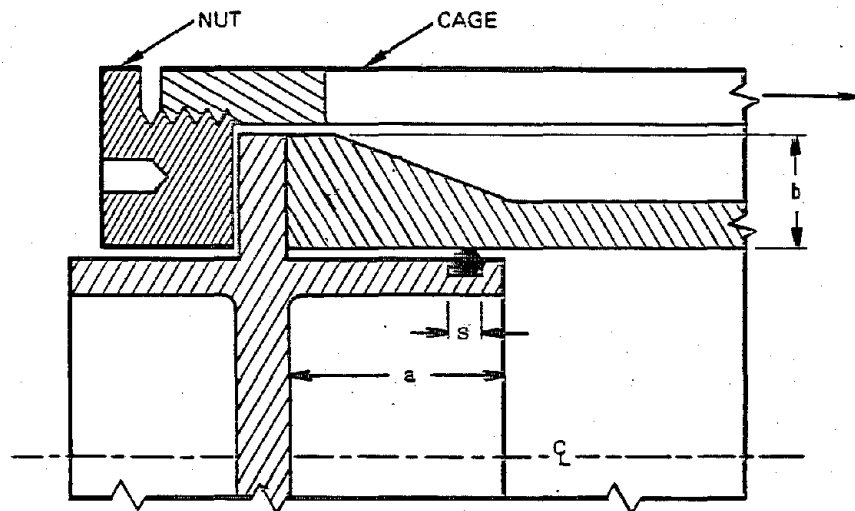
$a+b-s \geq 0.75$ in.
FOR VOL ≥ 124 in³
and $b \geq 1/4$ in.

(b)

Figure 8.15. Typical Mounting and Sealing Arrangements for Plastic Tubes



(a)

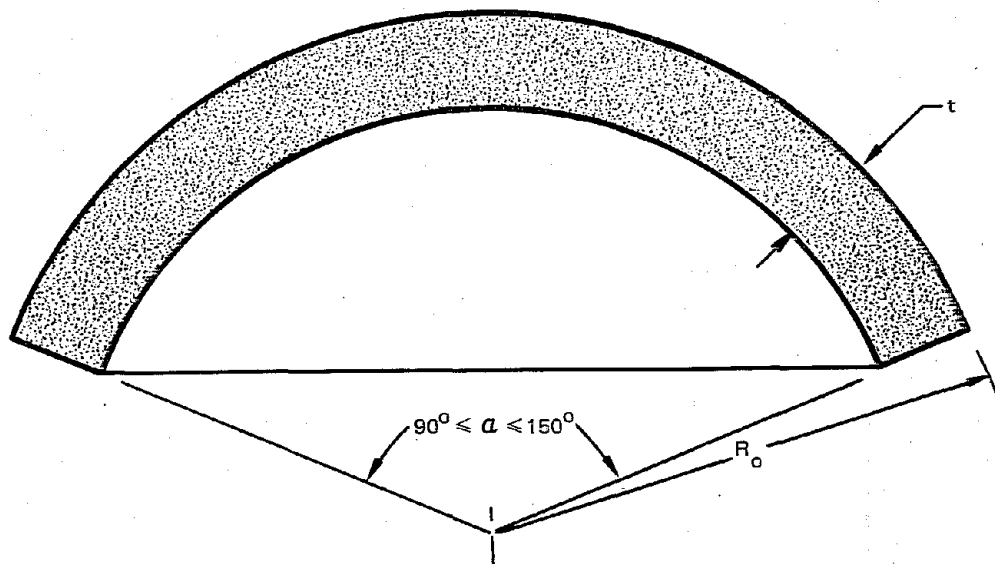


(b)

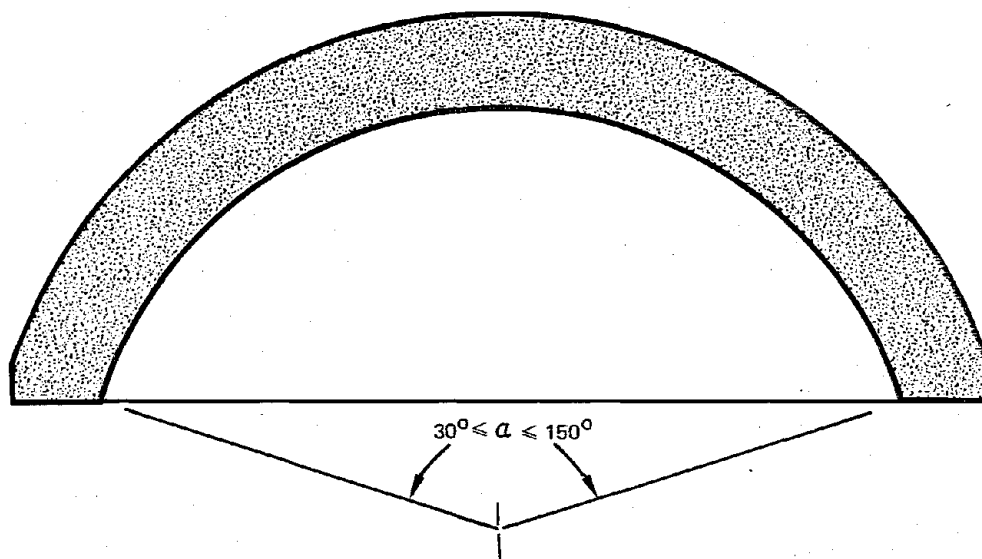
$$a + b - s \geq 0.75 \text{ in.}$$

$$\text{FOR VOL} \geq 124 \text{ in}^3$$

Figure 8.16. Typical Mounting and Sealing Arrangements for Plastic Tubes



a. SECTORS WITH CONICAL BEARING SURFACE.



b. SECTORS WITH RECTANGULAR BEARING SURFACES.

Figure 8.17. Standard Spherical Sector Window Geometries

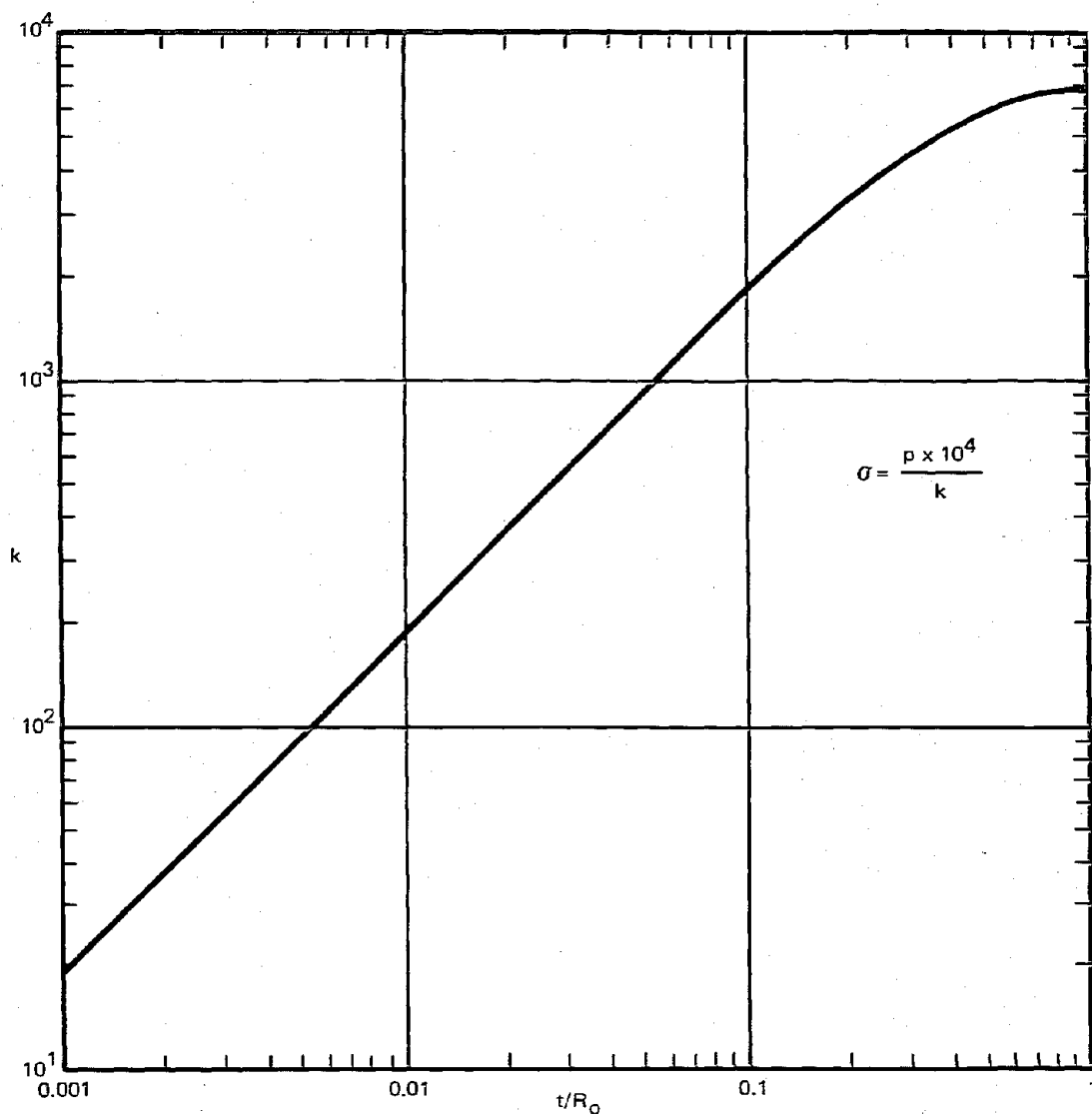


Figure 8.18. Maximum Compressive Stresses in Spherical Sectors

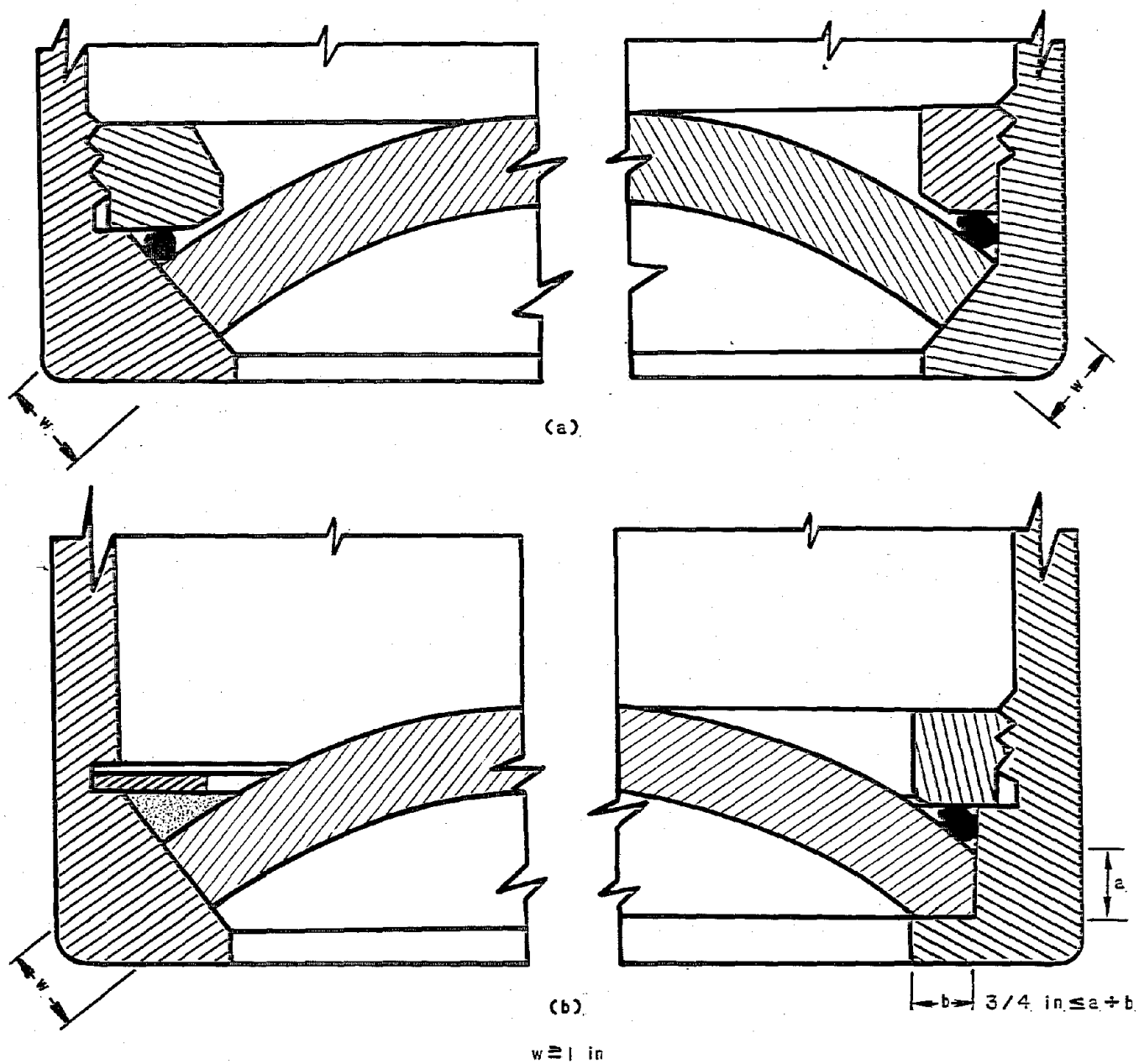
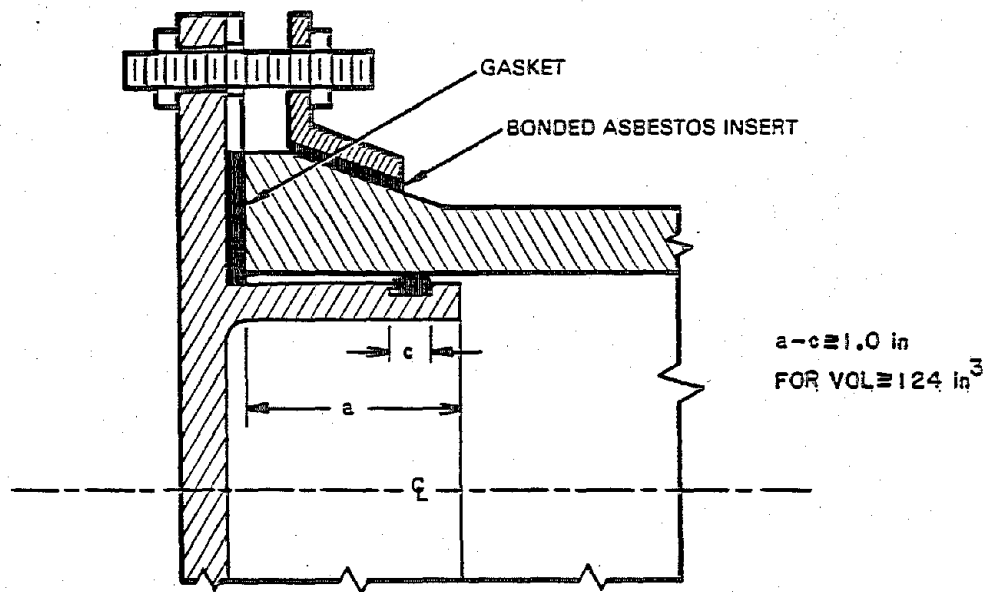
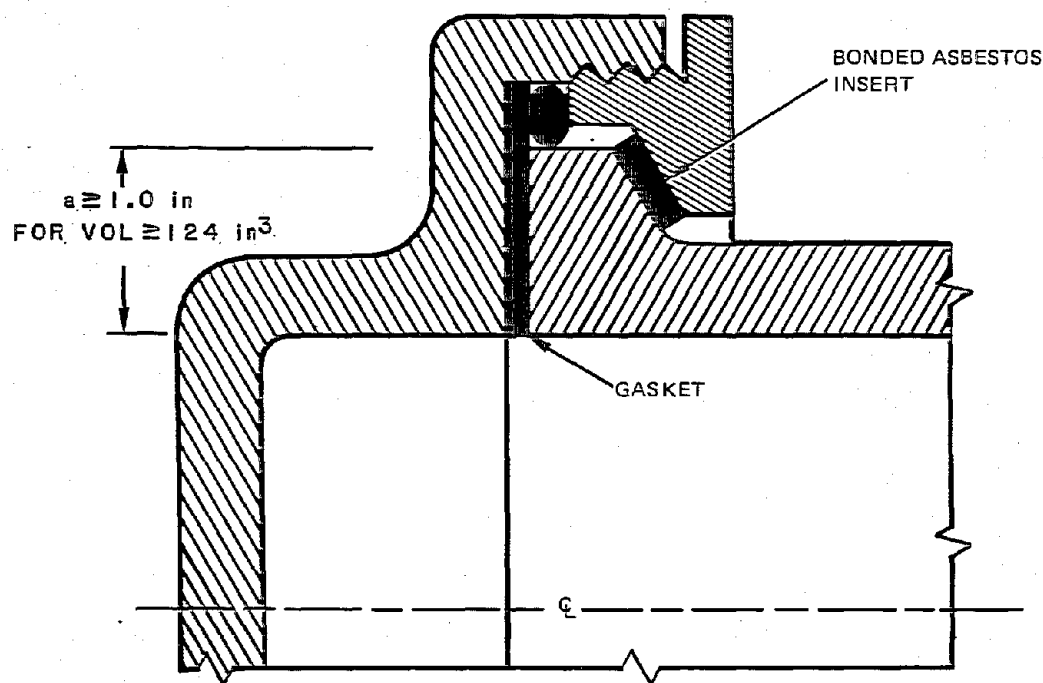


Figure 8.19. Typical Mounting and Sealing Arrangements for Plastic Spherical Sector Windows



(a)



(b)

Figure 8.20. Typical Mounting and Sealing Arrangements for Glass or Plastic Domes

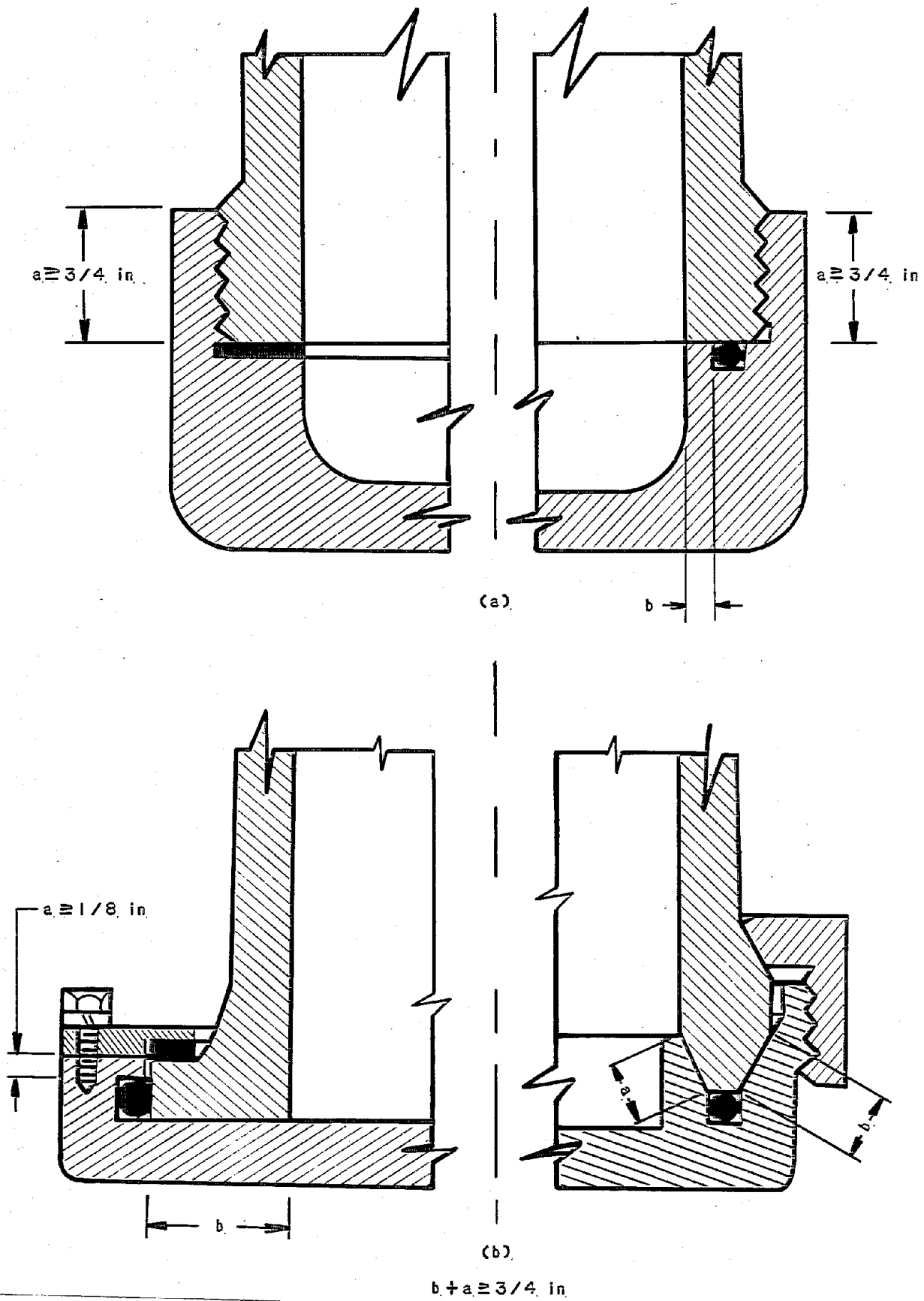


Figure 8.21. Typical Mounting and Sealing Arrangements for Plastic Domes

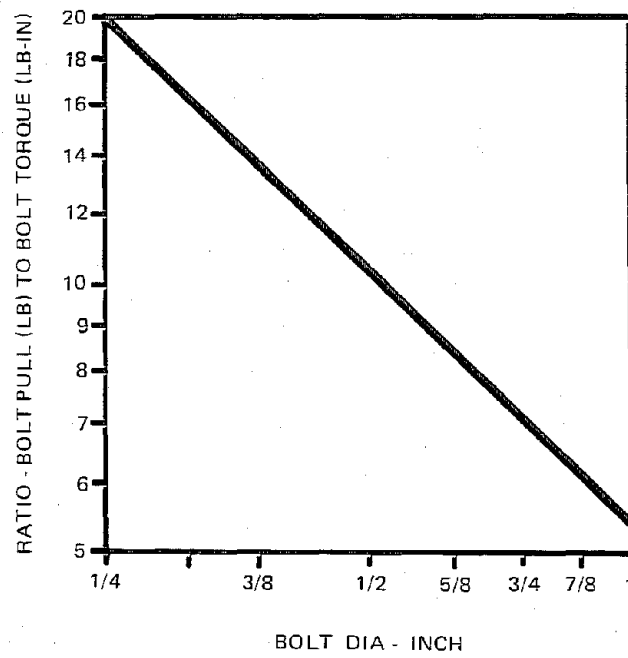
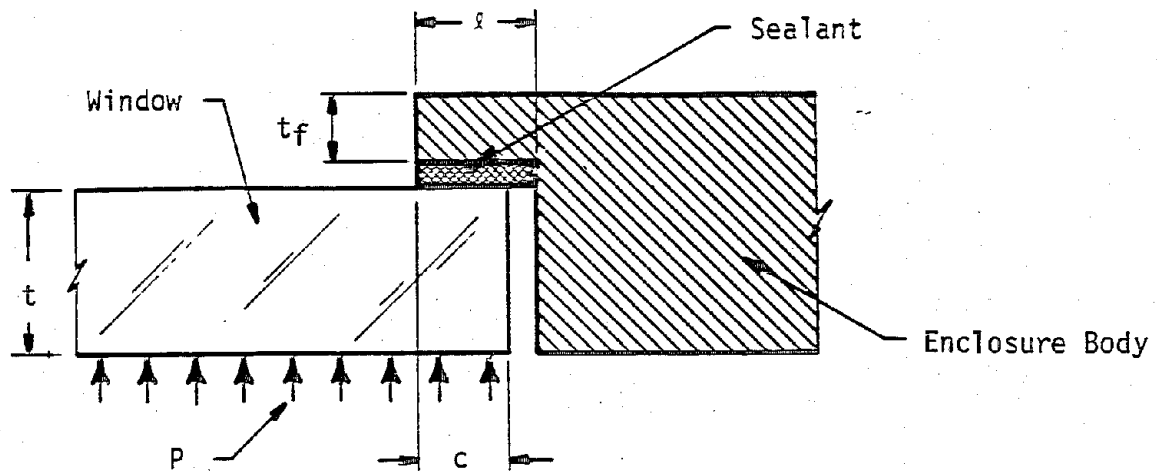


Figure 8.22. Compression Exerted by Bolts with Coarse, Dry Threads



Window Seat and Flange Geometry

For circular, square and rectangular windows:

strength requirement: $t_f \geq \left[\frac{2V_{MAX}(2l-c)}{\sigma_y} \right]^{1/2} \geq 3/16 \text{ inch}$

stiffness requirement: $t_f \geq \left[\frac{540 V_{MAX}(2l-c)^2}{\pi E} \right]^{1/3} \geq 3/16 \text{ inch}$

circular: $V_{MAX} = 0.25 pD$

square: $V_{MAX} = 0.42 pa$

rectangular: $V_{MAX} = 0.50 pa$

p = static design pressure

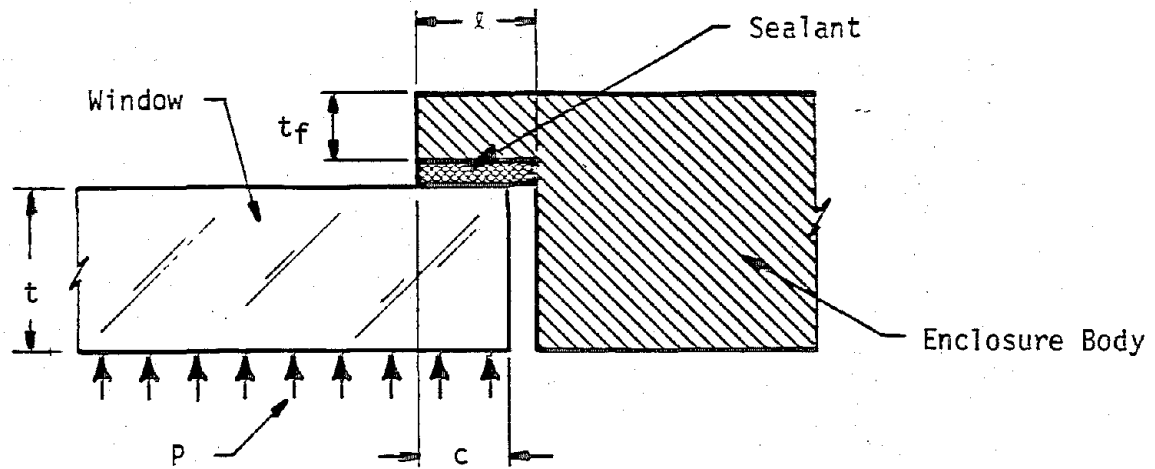
D = diameter of a circular window

a = narrow plate dimension

σ_y = yield strength of the enclosure material

E = elastic modulus of the enclosure material

Figure 8.23. Seat Flange Design for Plane Windows Subjected to Static Pressure



Window Seat and Flange Geometry

For circular and rectangular windows:

$$t_f \geq \left[\frac{2V_{\max}(2L-c)}{\sigma_y} \right]^{1/2} \geq 3/16 \text{ inch.}$$

$$\text{circular: } V_{\max} = \frac{8\sigma_g t^2}{3D(3+\nu)}$$

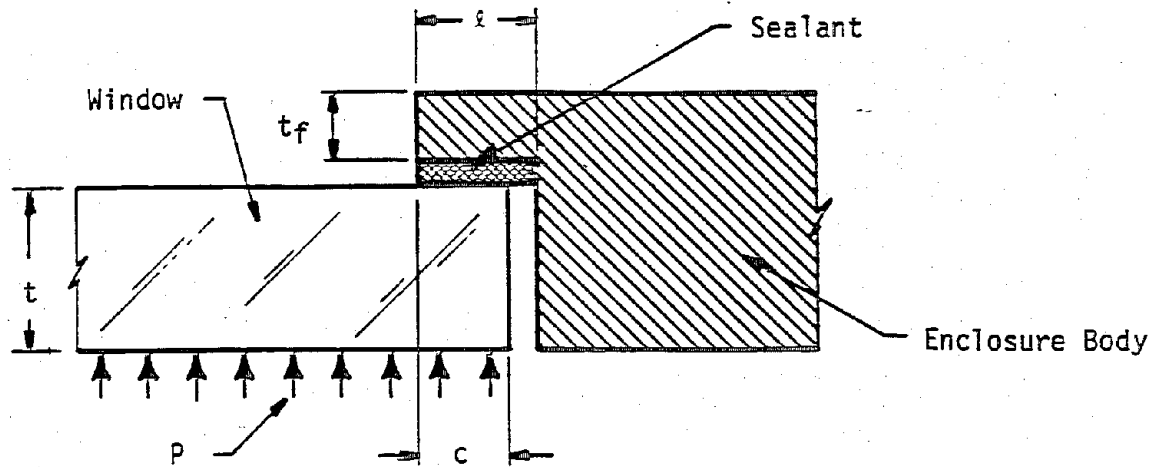
$$\text{rectangular: } V_{\max} = \frac{K\sigma_g t^2}{b}$$

a/b	1.0	1.2	1.4	1.6	1.8	2.0	3.0	4.0	∞
K	1.461	1.209	1.055	0.949	0.877	0.824	0.708	0.677	0.667

σ_g = glass impact breaking strength

ν = Poisson's ratio for the glass

Figure 8.24 Seat Flange Design for Plane Glass Windows Subjected to External Impact



Window Seat and Flange Geometry

For circular, square and rectangular windows:

$$t_f \geq \left[\frac{2V_{\max}(2l-c)}{\sigma_y} \right]^{1/2} \geq 3/16 \text{ inch}$$

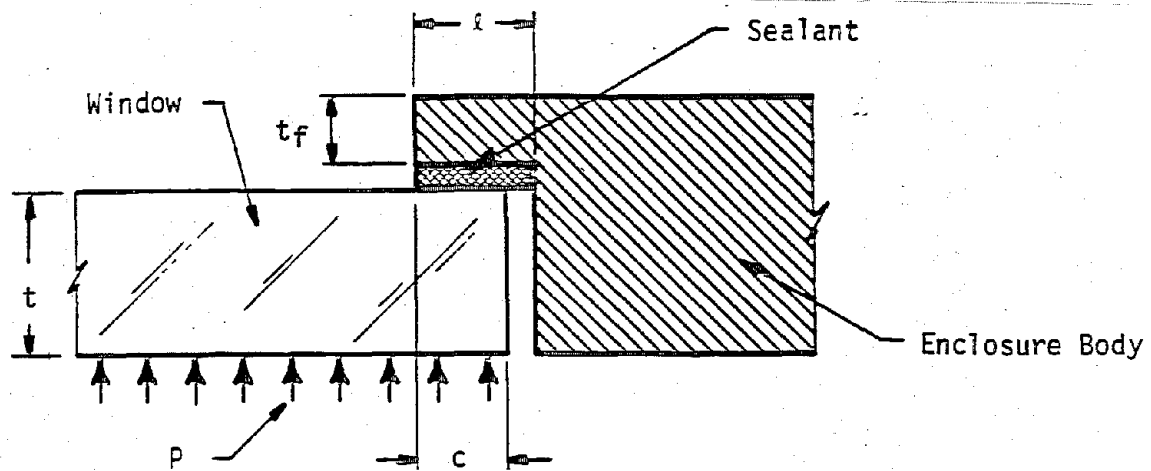
circular: $V_{\max} = \frac{1}{\pi D} \times (R_m \text{ from Equation 5.3 with } h=t)$

square: $V_{\max} = \frac{1}{4a} \times (R_m \text{ from Figure 5.1 with } h=t)$

rectangular: $V_{\max} = \frac{1}{2(a+b)} \times (R_m \text{ from Figure 5.1 with } h=t)$

Note: In calculating R_m use $E_j = 0$ for elastomeric gasket materials and $E_j = 1$ for metallic gasket materials and epoxies.

Figure 8.25. Seat Flange Design for Plane Plastic Windows Subjected to External Impact



Window Seat and Flange Geometry

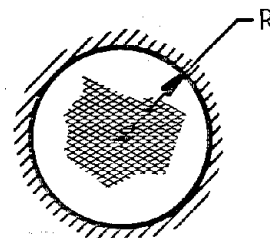
For circular, square or rectangular windows:

$$t_f \leq \left[\frac{9\sigma_{pc}(2l-c)c}{\sigma_y} \right]^{1/2} \geq 3/16 \text{ inch}$$

Note: σ_{pc} = precompression stress in the gasket or sealant material.

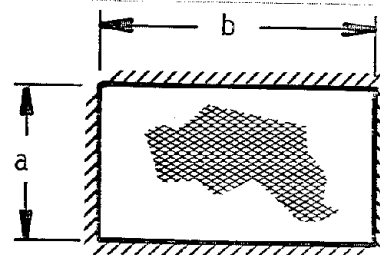
Figure 8.26. Seat Flange Design for Precompression Loads on Window Seats

Circular Guard



$$h = \left[\frac{W_o^2}{16} + \frac{1}{6} \frac{qR^2}{\sigma_y} \right]^{1/2} - \frac{1}{4} W_o$$

Rectangular Guard



$$h = \left[\frac{\pi^2}{1024} W_o^2 + \frac{q ab}{\pi^2 \sigma_y (a/b + b/a)} \right]^{1/2} - \frac{\pi^2}{32} W_o$$

h = equivalent thickness for the open mesh guard

W_o = allowable center deflection $\leq 0.2R$ (circular) or $\leq 0.2a$ (rectangular)

q = uniform design loading ≥ 300 psi

σ_y = yield stress of the guard material

R = radius to fixed boundary of the guard

a, b = dimensions to fixed boundary of the guard

Figure 8.27. Design of Open Mesh Window Guards

9.0 THERMAL STRESSES IN WINDOWS AND LENSES

Several factors contribute to the creation of thermal stresses in windows which are part of XP enclosures. The predominate ones are:

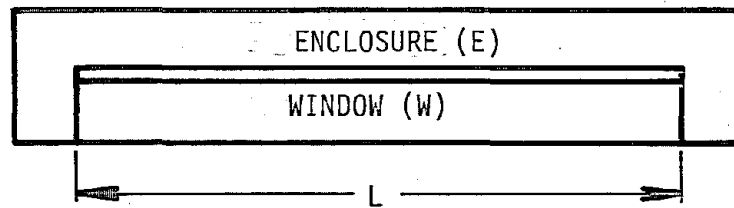
- o The joining together of dissimilar materials
- o Nonuniform temperatures in the enclosure
- o High temperature produced by internal lighting
- o External quenching by water spray

A detailed study of the stresses produced by these factors and others was made by Stewart, et al. [12]. They showed that very high local stresses are produced in enclosure windows, stresses that far exceeded those produced by simple quench testing of individual windows. The magnitudes of the stresses varied with the mounting configuration. Highest stresses occurred in glass windows bonded in place with epoxy adhesive. The most acceptable window configuration, when measured in terms of the ratio of the maximum thermal stress to the design stress, was a polycarbonate window mounted without gasket or adhesive.

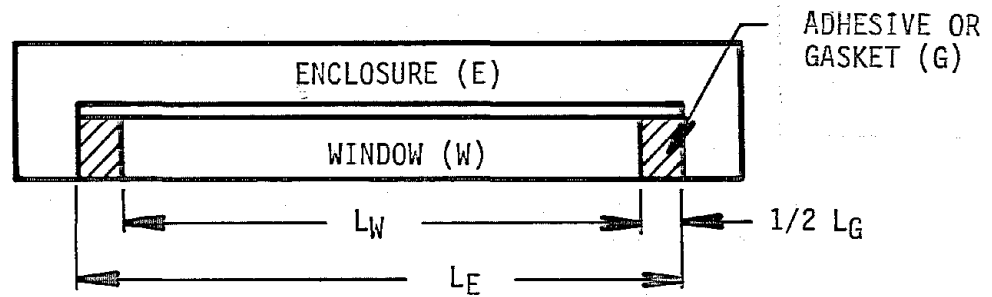
It is not possible to duplicate in this Guide the analyses in Reference 12, which were performed by the finite element method; however, some guidance can be obtained from the equations for rectangular windows in Figure 9.1 and the equations for circular windows in Figure 9.2. Further, some finite element calculations were made to provide a graphical solution for the localized thermal stresses which can occur at the interface in adhesively bonded glass windows.

Figures 9.1 and 9.2 give the thermally induced stresses for a window (or lense) that is restrained by an enclosure. Solutions are provided for windows with and without gaskets or adhesive.. The solutions assume that there is no through-thickness restraint at the interfaces between the window, the gasket or adhesive and the enclosure. Thus, they will not give the high localized stresses which can develop at the interface with adhesive bonds. These are given later.

To apply Figures 9.1 and 9.2, the maximum operating temperature of the enclosure, or the maximum temperature specified by MSHA (see Chapter 3), should be used. Figure 9.1 is for rectangular windows. It treats a strip



Axial Force:
$$F = \frac{(\alpha_E - \alpha_W) \Delta T}{\frac{1}{A_W E_W} + \frac{1}{A_E E_E}}$$



Axial Force:
$$F = \frac{(\alpha_E L_E - \alpha_W L_W - \alpha_G L_G) \Delta T}{\frac{L_W}{A_W E_W} + \frac{L_G}{A_G E_G} + \frac{L_E}{A_E E_E}}$$

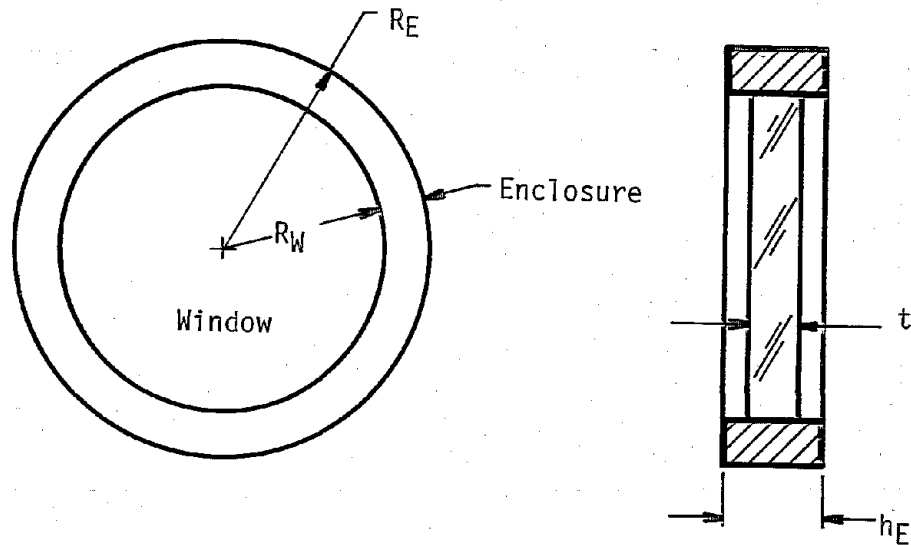
Stresses:
$$\sigma_i = \frac{F}{A_i} \quad i = W, G \text{ and } E$$

A = cross-sectional area

E = elastic modulus at service temperature

α = coefficient of thermal expansion at service temperature

Figure 9.1. Thermal Stresses in Rectangular Windows



Interface Loading @ $R = R_W$:

$$N_W = \frac{(\alpha_W - \alpha_E) \Delta T t}{\frac{1}{E_W} (1 - \nu_W) + \frac{1}{E_E} (t/h_E)} \left(\frac{R_E^2 + R_W^2 + \nu_E}{R_E^2 - R_W^2} \right)$$

Uniform Window Stress:

$$\sigma_W = - N_W / t$$

Enclosure Stress:

$$\sigma_{E_t} = \frac{R_E^2 + R_W^2}{R_E^2 - R_W^2} \times N_W / h_E \quad \text{Maximum Circumferential Stress}$$

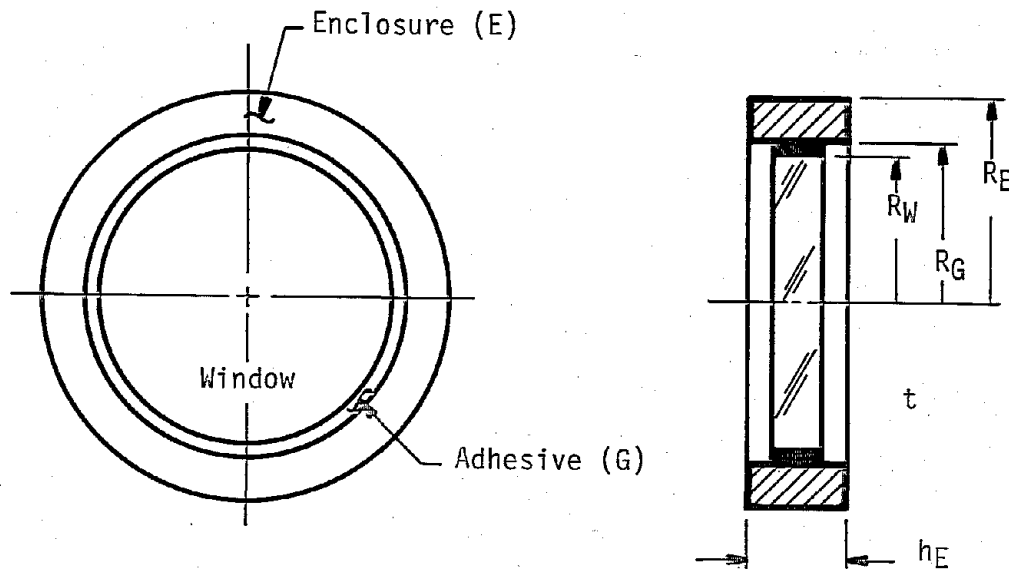
$$\sigma_{E_r} = - N_W / h_E \quad \text{Maximum Radial Stress}$$

ν = Poisson's ratio

α = coefficient of thermal expansion

(a) No Gasket or Adhesive

Figure 9.2 Thermal Stresses in Circular Windows



Interface Loads:

$$N_W = \frac{t \Delta T [(\alpha_G - \alpha_W) C_4 + (\alpha_E - \alpha_G) C_6]}{C_4 C_5 - C_6 C_7}$$

$$N_G = \frac{1}{C_4} [t \Delta T (\alpha_E - \alpha_G) + C_7 N_W]$$

Maximum Stress: $\sigma_W = -N_W/t$ (Uniform Stress)

Maximum Gasket Stress:

$$\text{Radial, } \sigma_{G_r} = \frac{\text{Max. of } (N_W, N_G)}{t}$$

$$\text{Circumferential, } \sigma_{G_c} = \frac{N_W C_2 - N_E C_1}{t}$$

Maximum Enclosure Stress:

$$\text{Radial, } \sigma_{E_r} = -N_G/h_E$$

$$\text{Circumferential, } \sigma_{E_c} = \frac{N_G C_3}{h_E}$$

Where:

$$C_1 = \frac{2R_G^2}{R_G^2 - R_W^2} \quad C_2 = \frac{R_G^2 + R_W^2}{R_G^2 - R_W^2} \quad C_3 = \frac{R_E^2 + R_G^2}{R_E^2 - R_G^2}$$

$$C_4 = \frac{1}{E_G} \frac{2R_W^2}{R_G^2 - R_W^2} \quad C_5 = C_1/E_G$$

$$C_6 = \frac{C_2 + \nu_G}{E_G} + \frac{1 - \nu_W}{E_W} \quad C_7 = \frac{C_2 - \nu_G}{E_G} + \left(\frac{t}{h_E}\right) \left(\frac{C_3 + \nu_E}{E_E}\right)$$

(b) Window with Gasket or Adhesive

Figure 9.2 (cont'd) Thermal Stresses in Circular Windows

from the enclosure in either the long or short dimension. Usually the long dimension will give the highest stress. The solution can also be used for computing the stress which develops in the window between flanges. In this case, the length is measured in the thickness direction, as shown in Figure 9.3. The areas are (see Figure 9.3):

$$A_w = 2(c)(l)$$

$$A_g = c(l)$$

$$A_e = c(l)$$

where l is the length or width of the window, or a unit dimension. For computing the stress, let

$$A_w = c(l)$$

and all other areas remain the same. This helps to account for the nonuniformity of the stress in the windows edge.

Figure 9.2 is for cylindrical windows. It is based on the same assumptions as for Figure 9.1, that is, it ignores through-thickness stresses which can occur in adhesively-bonded windows. It gives only the stresses produced by radial restraint of the window, or window and gasket, by the enclosure.

A graphical solution for the interface stresses in adhesively bonded glass windows is given in Figure 9.4. Stresses at the interface are a function of the window thickness, the adhesive thickness and the temperature. Figure 9.4 corresponds to a temperature change from 70°F to 302°F, the maximum allowable temperature for the enclosure as specified by MSHA. Peak stresses at lower temperature, T , can be estimated by Equation 9.1.

$$\sigma_{\text{glass}} = (\sigma_{\text{glass}} \text{ from Figure 9.4}) \times \frac{T, ^\circ\text{F} - 70}{232} \quad (9.1)$$

Stresses in the epoxy are also higher, but they are less affected by the epoxy or glass thickness. For all of the calculations, the range of the

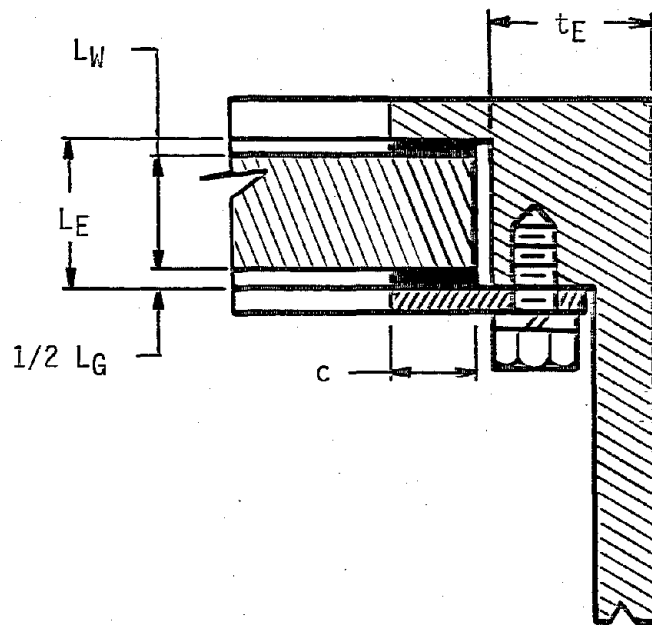


Figure 9.3. Geometry of Flange Configuration for Computing Thermal Stresses

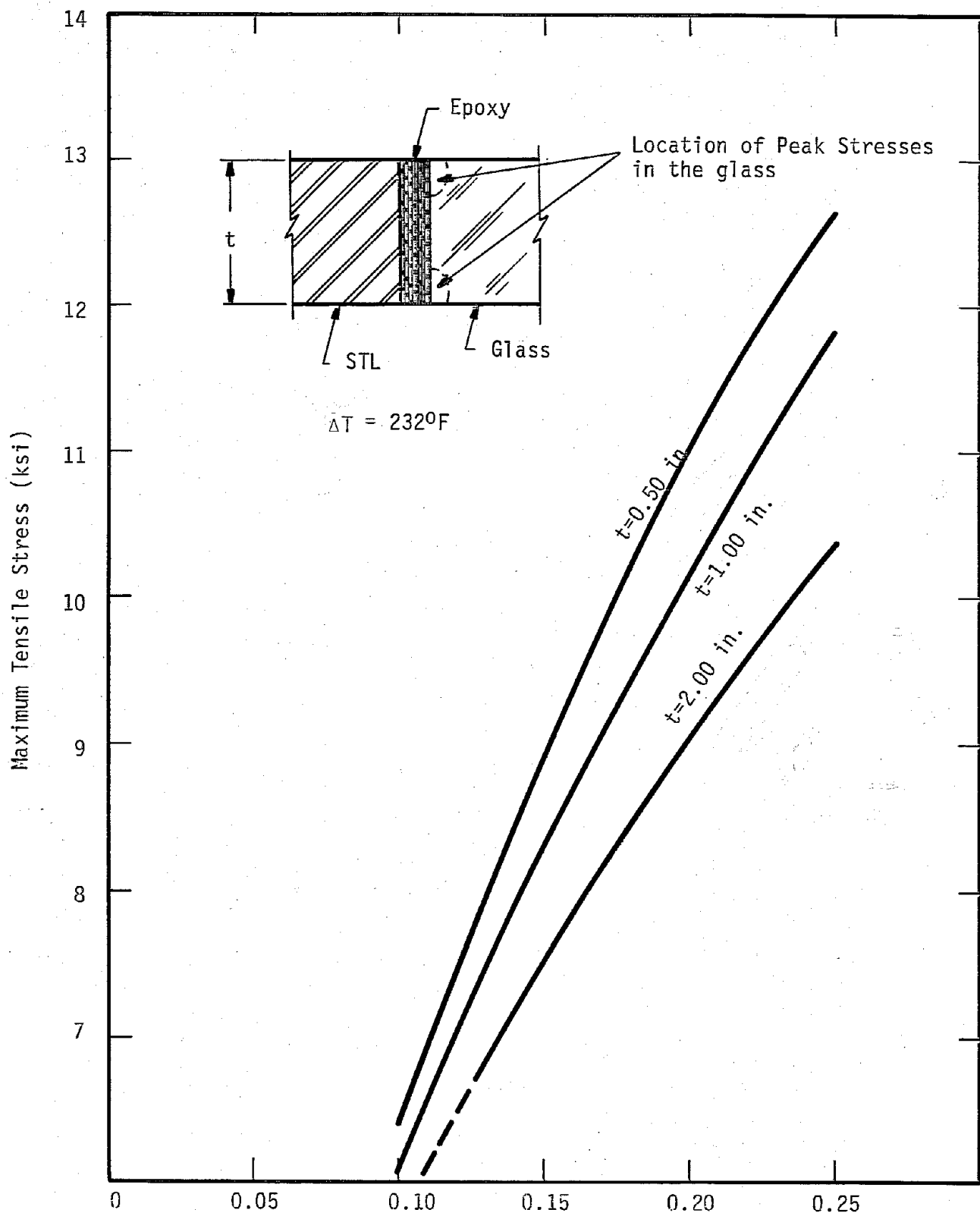


Figure 9.4 Thermal Stresses at the Interface in Epoxy-Bonded Glass Windows

maximum tensile stress in the epoxy was 8.5 ksi to 10.0 ksi; the range of the maximum compressive stress was -14.2 ksi to -21.3 ksi. Stresses of about the same magnitude are also produced in the steel.

In general, the stresses in epoxy-bonded windows will be too high for most applications. The temperature differential must be quite low in order to produce acceptable stress levels. Thus, the use of epoxy, as an adhesive for glass windows, is not recommended.

10.0 WELDED CONNECTIONS

Five basic functions or steps are required to achieve a satisfactory welded joint. These are:

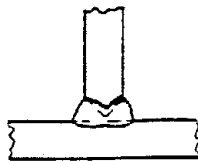
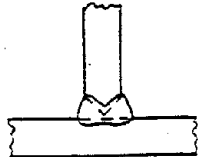
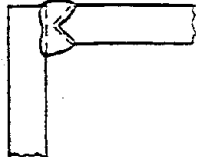
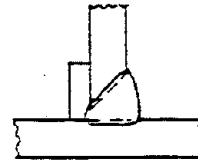
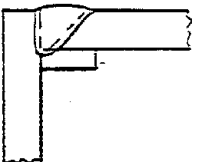
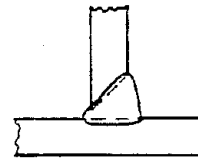
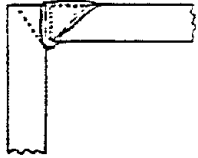
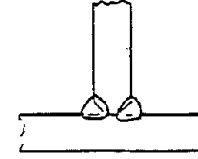
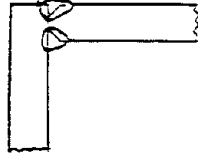
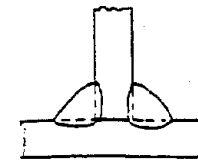
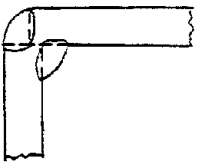
1. Joint Design
2. Welding Procedure Qualification
3. Welder or Welding Operator Qualification
4. Welding Procedure Specification
5. Inspection and Acceptance Criteria for Weldment

Of these, only items 1 and 2 relate directly to the design of the enclosure. The others relate more to fabrication and production quality. Even so, because of their importance in assuring a satisfactory weld connection, all of them are addressed in this Guide, but emphasis is placed on Joint Design.

These five functions are covered to varying depths in many welding codes. A review of available welding codes was made [2], and the American Welding Society (AWS) code D14.4 [13] was found to be most appropriate for use in fabricating XP enclosures. With the permission of AWS, excerpts of D14.4, which pertain to joint design have been included in this Guide, and reference is made to other sections. To follow comments in Sections 10.3 through 10.5 which follow requires that a copy of D14.4 be available for reference.

10.1 Joint Design

Classification of welded joints according to D14.4 is given in Figure 10.1. The importance of joint design is the efficiency, relative to the base metal, which can be achieved by the joint; however, efficiency is achieved, not only by design, but also by inspection and an appropriate acceptance criterion. Thus, the joints are divided into six (6) classes which progress from full radiographic inspection for Class I to visual inspection only for Class VI. Inspection requirements by class are included in Table 10.1. Most enclosures are made with Class IV through Class VI weld joints and these require only visual and dimensional inspection (see Section 10.5). Classes I, II, and III can be used anytime the designer considers it beneficial to have a higher joint efficiency. Allowable discontinuities in Class I through VI

Class	Joint efficiency ¹		Configuration of welded joints ³		
	Static	Dynamic ²			
I	100%	100%			
II	100%	75%			
III	90%	60%			
					
IV	80%	40%			
					
					

Note: d = diameter

1. The allowable range for stress must be multiplied by the joint efficiency to establish the permissible design stress.
2. 20 000 Hz minimum.
3. Details of weld joint (square-groove, V-groove, root opening, etc.) as required for the welding process to be used.

Figure 10.1. Classification of Welded Joints (Fig. 2.1 of Ref. 13)

Class	Joint efficiency ¹		Configuration of welded joints ³		
	Static	Dynamic ²			
V	50%	20%			
VI	20%	—			

Note: d = diameter

1. The allowable range of stress must be multiplied by the joint efficiency to establish the permissible design stress.
2. 20 000 Hz minimum.
3. Details of weld joint (square-groove, V-groove, root opening, etc.) as required for the welding process to be used

Figure 10.1. Classification of Welded Joints (Fig. 2.1 of Ref. 13) Continued.

Table 10.1 Weld Quality Assurance Requirements (From Ref. 13)

Weld Class (see Fig. 10.1)	Ultrasonic or radiographic inspection	Magnetic particle or liquid penetrant inspection	Visual Inspection	Dimensional inspection
I	yes (100%)	yes (100%)	yes (100%)	yes (100%)
II	yes	yes	yes	yes
III		yes	yes	yes
IV			yes	yes
V			yes	
VI			yes	

welds are given in Table 10.2. These give an indication of the visual appearance of the welds.

For XP enclosures, the designer must consider both the static joint efficiency and the dynamic joint efficiency. For the 150 psig static design pressure, the static joint efficiencies are used. For dynamic loading, produced by an internal explosion, the dynamic joint efficiency is used. Obviously, a Class VI joint is unacceptable for dynamic loading. It should be noted that the frequency response of the structure probably will not be above 20,000 Hz, even for an internal explosion; however, we have chosen to use the dynamic joint efficiency in design calculations because the loading is dynamic and may stress the joint beyond its yield point. In static pressure tests on enclosures [2] progressive deterioration has been observed in some Class V weld joints when stressed beyond its yield point.

Weld joint efficiency will often determine the allowable or design stress in the base metal of the enclosure. If, for example, the maximum stress in one side of an enclosure occurs at the welded boundary, then the allowable stress in the base metal is set by the weld joint efficiency if it is less than 100%. A 50% joint efficiency means that the enclosure wall can only be designed for 50% of the strength. In cases where the peak stress in the base metal does not occur at the welded joint, the joint efficiency might not control the design stress, but it will affect the design. Procedures for utilizing the weld joint efficiencies of Figure 10.1 in the design of the enclosure are given in Chapter 5.

The general joint configuration of Figure 10.1 does not provide the detail geometry of the joint which is necessary to assure a good weld. These

Table 10.2. Allowable Structural Discontinuities (Table 7.17.4, Ref. 13)

Class of weld quality	Extent of visual weld defects allowed				Weld bead irregularities
	Cracks	Undercut	Inadequate joint penetration	Surface holes	
Class I	None	Visually free from undercut in direction transverse to primary stress. 0.25 mm (0.01 in.) maximum depth smoothly contoured undercut parallel to direction of primary stress.	Visually free from all evidence of inadequate joint penetration or other types of fusion defects at root of weld.	Sum of 0.8 mm (1/32 in.) maximum diameter scattered or randomly distributed surface holes not to exceed 3 mm per 645 mm ² (1/8 in. per sq. in.) or 6 mm per 305 mm length (1/4 in. per 12 in. length). Linear orientation of holes not allowed.	Surface of weld to be ground or machined to produce smooth, uniform profile blending with base metal without notches, depressions or sharp edges.
Class II	None				
Class III	None	Undercut 0.25 mm (0.01 in.) maximum depth when direction transverse to primary stress. 0.8 mm (1/32 in.) maximum depth when direction parallel to primary stress.	1/3 T or 13 mm (1/2 in.) maximum length inadequate penetration. Sum of all defects not to exceed 25 mm (1 in.) in 305 mm (12 in.).	Sum of 1.5 mm (1/16 in.) maximum diameter surface holes not to exceed 6 mm per 645 mm ² (1/4 in. per sq. in.) or 13 mm (1/2 in.) per 305 mm length.	Rough, irregular welds and excess reinforcement to be ground smooth.
Class IV	None		2/3 T or 19 mm (3/4 in.) maximum length inadequate penetration. Sum of all defects not to exceed 25 mm (1 in.) in 152 mm (6 in.).	Sum of 2 mm (3/32 in.) maximum diameter surface holes not to exceed 10 mm per 645 mm ² (3/8 in. per sq. in.) or 19 mm in 305 mm length (3/4 in. in 12 in. length).	X
Class V	None	Undercut 0.8 mm (1/32 in.) maximum depth when direction transverse to primary stress. 1/4 T or 1.5 mm (1/16 in.) maximum depth when direction parallel to primary stress.	T or 25 mm (1 in.) maximum length inadequate penetration. Sum of all defects not to exceed 25 mm (1 in.) in 152 mm (6 in.).	X	X
Class VI	None		X	X	X

details can be developed by the designer, in which case they must be qualified, or prequalified joints can be used as described in the next section.

10.2 Prequalified Welding Procedures

Prequalification of a welding procedure specification (WPS) refers to the use of certain weld joint details, materials and processes which are permitted in the Welding Standard without performing any procedure qualification or testing. The purpose in qualifying a welding procedure or using a prequalified procedure is to provide assurance that quality welds and strength levels can be produced within a certain range of welding variables using the materials and processes tested. Procedure qualification provides a demonstration that sound welds can be made and offers a measure of quality assurances for product liability.

Details of welded joints (paragraph 3.3 [13]) and the fillet weld details for carbon and low-alloy steels (paragraph 3.3.2 [13]) may be used with the designated welding processes without performing a procedure qualification. Weldments made under these guidelines are designated as prequalified joints. Figures 10.2 through 10.7 show the choices for prequalified procedure, process, and joint parameters.

10.3 Welder Qualification Testing (Section 6, Parts A and C [13])

Three approaches are provided in paragraph 6.3 [13] for qualifying welders, welding operators, or tackers. The first approach is welder qualification according to Part C of the Standard. Part C covers the variables that must be tested in order to match production requirements. A second approach is to accept evidence of previous qualification of the welders, i.e., from previous employment, schooling and certification, state certification, etc. Accepting evidence of previous qualification of a welder is very practical and is based largely on the premise that the welder has continued to make satisfactory welds. This premise is usually valid if the welder has used the welding process within a six-month period. Judgement on acceptance of welders is left to the discretion of the Engineer. If previous qualification is accepted, the Engineer will normally keep a record on file of

3.3 Details of Welded Joints

3.3.1 Joint Qualification

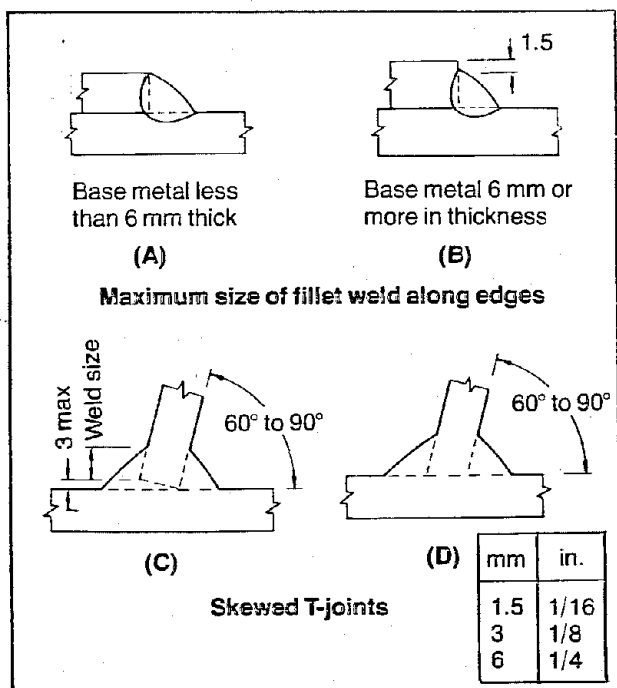
3.3.1.1 Carbon and low alloy steel joints which conform to the detail requirements given herein and which are to be welded using manual shielded metal arc or submerged arc procedures are designated as prequalified and may be used without performing additional joint welding procedure qualification tests.

3.3.1.2 Other joints and materials may be used only if it is adequately demonstrated, by procedure qualification in accordance with Section 6, that the proposed joint welding procedure meets the requirements of the specification and the application.

3.3.2 Fillet Weld Details for Carbon and Low Alloy Steels

3.3.2.1 The details of fillet welds made by manual shielded metal arc welding, submerged arc welding, gas metal arc welding or flux cored arc welding, which may be used without joint welding procedure qualification, are ...detailed in Fig. 3.3.2.1 (Fig. 10.2)

3.3.2.2 The minimum fillet weld size, except that of fillet welds used to reinforce groove welds, shall be as shown in Table 3.3.2.2. (Table 10.3)



All dimensions in millimeters except angles

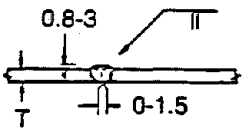
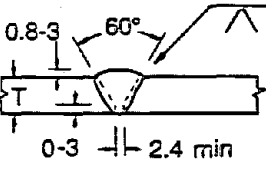
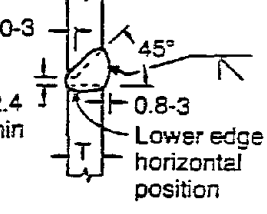
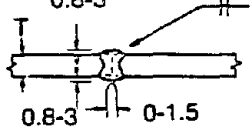
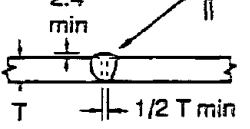
Table 10.3. Minimum fillet weld size
(Table 3.3.2.2, Ref. 13)

Material thickness of thicker part joined		Minimum size of fillet weld	
mm	in.	mm	in.
To 6 inclusive	To 1/4 inclusive	3	1/8
Over 6 to 13	Over 1/4 to 1/2	5	3/16
Over 13 to 19	Over 1/2 to 3/4	6	1/4
Over 19 to 38	Over 3/4 to 1-1/2	8	5/16
Over 38 to 57	Over 1-1/2 to 2-1/4	10	3/8
Over 57 to 152	Over 2-1/4 to 6	13	1/2
Over 152	Over 6	16	5/8

Note: The weld size need not exceed the thickness of the thinner part joined.

Figure 10.2. Details for Fillet Welds
(Fig. 3.3.2.1)

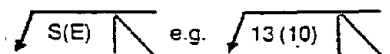
*Section 10.3 in this report

Welds Joints	Square-groove weld (1)	Single-V-groove weld (2)	Single-bevel-groove weld (4)
Butt joint (B) $T \leq 13$	 Effective throat (E)=T max T=3 B-P1a*	 Effective throat (E)=T max T=13 B-P2*	 Effective throat (E)=T max T=13 B-P4*
	Root need not be chipped before welding second side  Effective throat (E)=T max T=6 B-P1b		
	 Effective throat (E)=$\frac{3}{4} T$ max T=6 B-P1c*		

All dimensions in millimeters except angles

Notes:

1. Groove depth (S) and effective throat (E) should be shown on the weld symbol as follows:

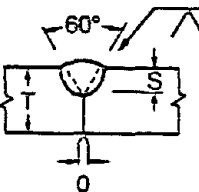
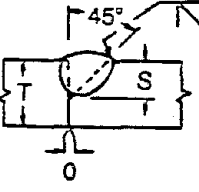
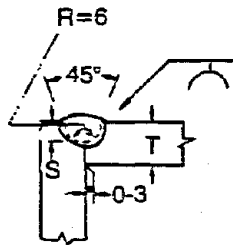
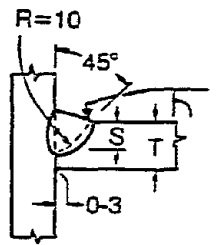
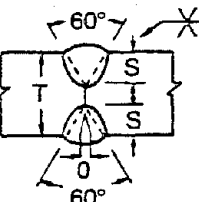
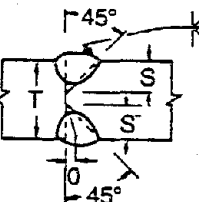
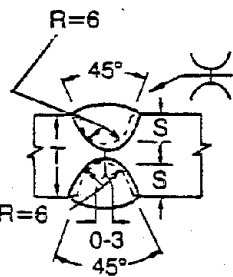
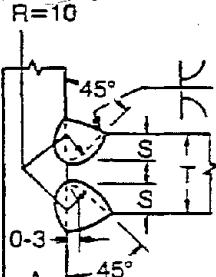


2. Refer to Table 10.4 for symbols.

* Joints welded from one side

mm	in.
0.8	1/32
1.5	1/16
2.4	3/32
3	1/8
6	1/4
10	3/8
13	1/2

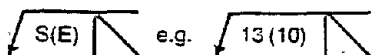
Figure 10.3. Partial Joint Penetration (P) Prequalified Shielded Metal Arc Welded Joints (Fig. 3.2.5, Ref. 13).

Welds Joints		V-groove weld	Bevel-groove weld	U-groove weld	J-groove weld
		Single-V-groove weld (2)	Single-bevel-groove weld (4)	Single-U-groove weld (6)	Single-J-groove weld (8)
Butt (B), T- (T) or corner (C) joint	Minimum root face of joint shall be 3 mm	 Effective throat (E)=S EC-P2	 Effective throat (E)=S-3 BTC-P4*	 Effective throat (E)=S EC-P6*	 Effective throat (E)=S BTC-P8*
		Double-V-groove weld (3)	Double-bevel-groove weld (5)	Double-U-groove weld (7)	Double-J-groove weld (9)
		 Effective throat (E)=S B-P3	 Effective throat (E)=S-3 BTC-P5*	 Effective throat (E)=S B-P7	 Effective throat (E)=S BTC-P9*

* All dimensions in millimeters except angles

Notes:

1. Groove depth (S) and effective throat (E) should be shown on the weld symbol as follows:

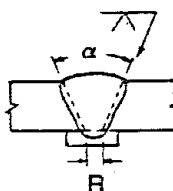
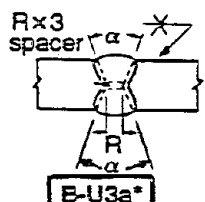
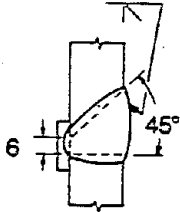
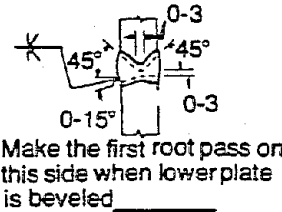
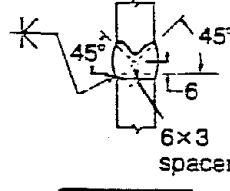
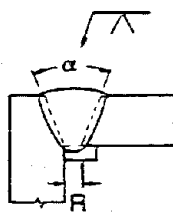
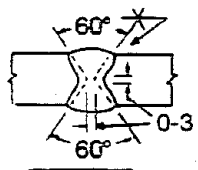
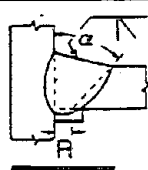
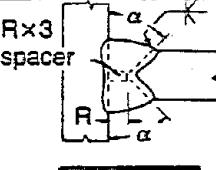
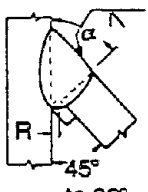
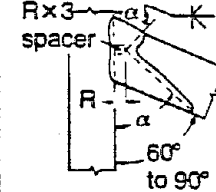
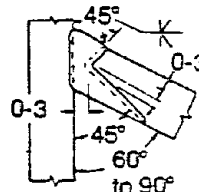


2. Refer to Table 10.4 for symbols.

mm	in.
3	1/8
6	1/4
10	3/8
13	1/2

*For corner joints, the outside groove preparation may be in either or both members, provided the basic groove configuration is not changed and adequate edge distance is maintained to support the welding operation without excessive edge melting.

Figure 10.3 (Cont). Partial Joint Penetration (P) Prequalified Shielded Metal Arc Welded Joints (Fig. 3.2.5, Ref. 13).

Welds Joints	V-groove weld		Bevel-groove weld		
	Single V-groove (2)	Double V-groove (3)	Single bevel-groove (4)	Double bevel-groove (5)	
Butt joint (B)	 B-U2a	 B-U3a*	 B-U4a**	 B-U5a*	 *B-U5b**
	T-joint (T) or corner joint (C)	 C-U2a	 B-U3b*	 TC-U4c	 TC-U5a*
			 TC-U4d	 TC-U5c*	 TC-U5d*

All dimensions in millimeters except angles

Limitations for joints
B-U2a, B-U3a* and C-U2a

α	R	Permitted welding positions
45°	6	All positions
30°	10	Flat and overhead only
20°	13	Flat and overhead only

Limitations for joints
TC-U4c, TC-U4d, TC-U5a* and TC-U5c*

α	R	Permitted welding positions
45°	6	All positions
30°	10	Flat and overhead only

mm	in.
3	1/8
6	1/4
10	3/8
13	1/2
16	5/8

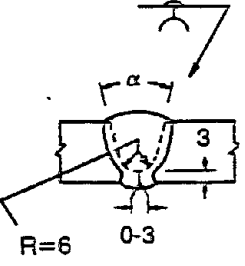
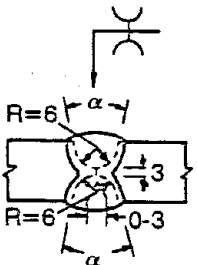
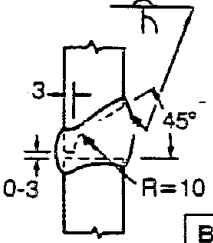
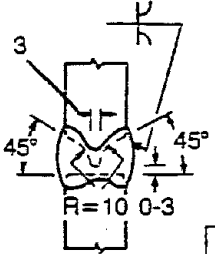
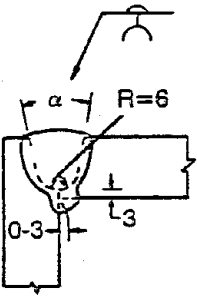
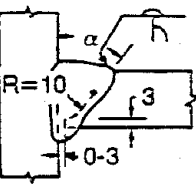
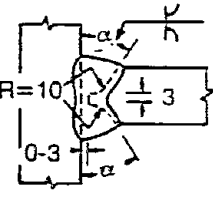
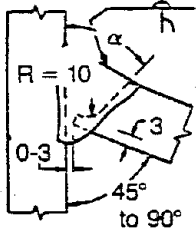
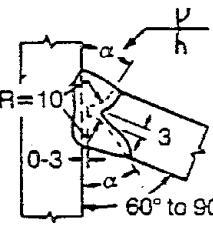
Notes:

- Gouge roots of joints without backing before welding other side.
- If fillet welds are used to reinforce groove welds in T- and corner joints, they shall be equal to T/4 but need not exceed 10 mm. Groove welds in T- and corner joints shall be reinforced with fillet welds equal to T/4 but not more than 10 mm. T is the thickness of the groove weld.
- Refer to Table 10.4 for symbols.

*The use of these welds preferably shall be limited to base metal thickness of 16 mm or larger.

**The use of these welds is recommended for the horizontal or flat position.

Figure 10.4. Complete Joint Penetration Prequalified Shielded Metal Arc Welded Joints--Base Metal of Unlimited Thickness (U).
(Fig. 3.3.4.1, Ref. 13)

Welds Joints	U-groove weld		J-groove weld	
	Single-U-groove (6)	Double-U-groove (7)	Single-J-groove (8)	Double-J-groove (9)
Butt joint (B)	 B-U6	 B-U7*	 B-U8**	 B-U9*
T-joint (T) or corner joint (C)	 C-U6		 TC-U8a	 TC-U9a*
			 TC-U8b	 TC-U9b*

All dimensions in millimeters except angles

Limitations of joints
B-U6, B-U7* and C-U6

α	Permitted welding positions
45°	All positions
20°	Flat and overhead only

Limitations of joints
TC-U8a, TC-U8b, TC-U9a* and TC-U9b*

α	Permitted welding positions
45°	All positions
30°	Flat and overhead only

mm	in.
3	1/8
6	1/4
10	3/8
16	5/8

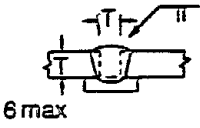
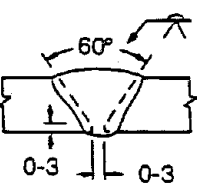
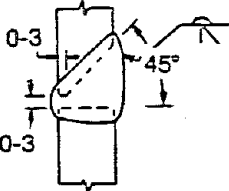
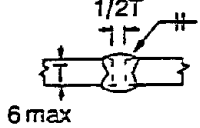
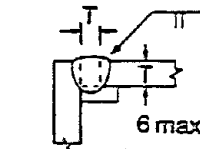
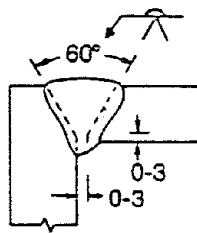
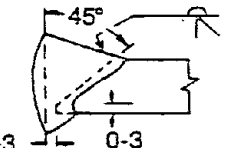
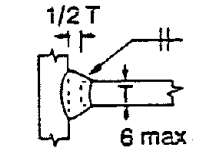
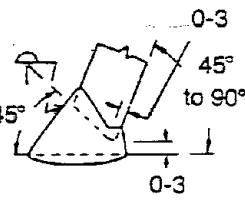
Notes:

- Gouge roots of joints without backing before welding other side.
- If fillet welds are used to reinforce groove welds in T- and corner joints, they shall be equal to T/4 but need not exceed 10 mm. Groove welds in T- and corner joints shall be reinforced with fillet welds equal to T/4 but not more than 10 mm. T is the thickness of the groove weld.
- Refer to Table 10.4 for symbols.

*The use of these welds preferably shall be limited to base metal thickness of 16 mm or larger.

**The use of these welds is recommended for the horizontal or flat position.

Figure 10.4 (Cont). Complete Joint Penetration Prequalified Shielded Metal Arc Welded Joints--Base Metal of Unlimited Thickness (U). . (Fig. 3.3.4.1, Ref. 13)

Welds Joints	Square-groove weld (1)	Single-V-groove weld (2)	Single-bevel-groove weld (4)
Butt joint (B)	 B-L1a	 B-U2	 B-U4
	 B-L1b		
T-joint (T) or corner joint (C)	 C-L1a	 C-U2	 TC-U4a*
	 TC-L1b		 TC-U4b*

All dimensions in millimeters except angles

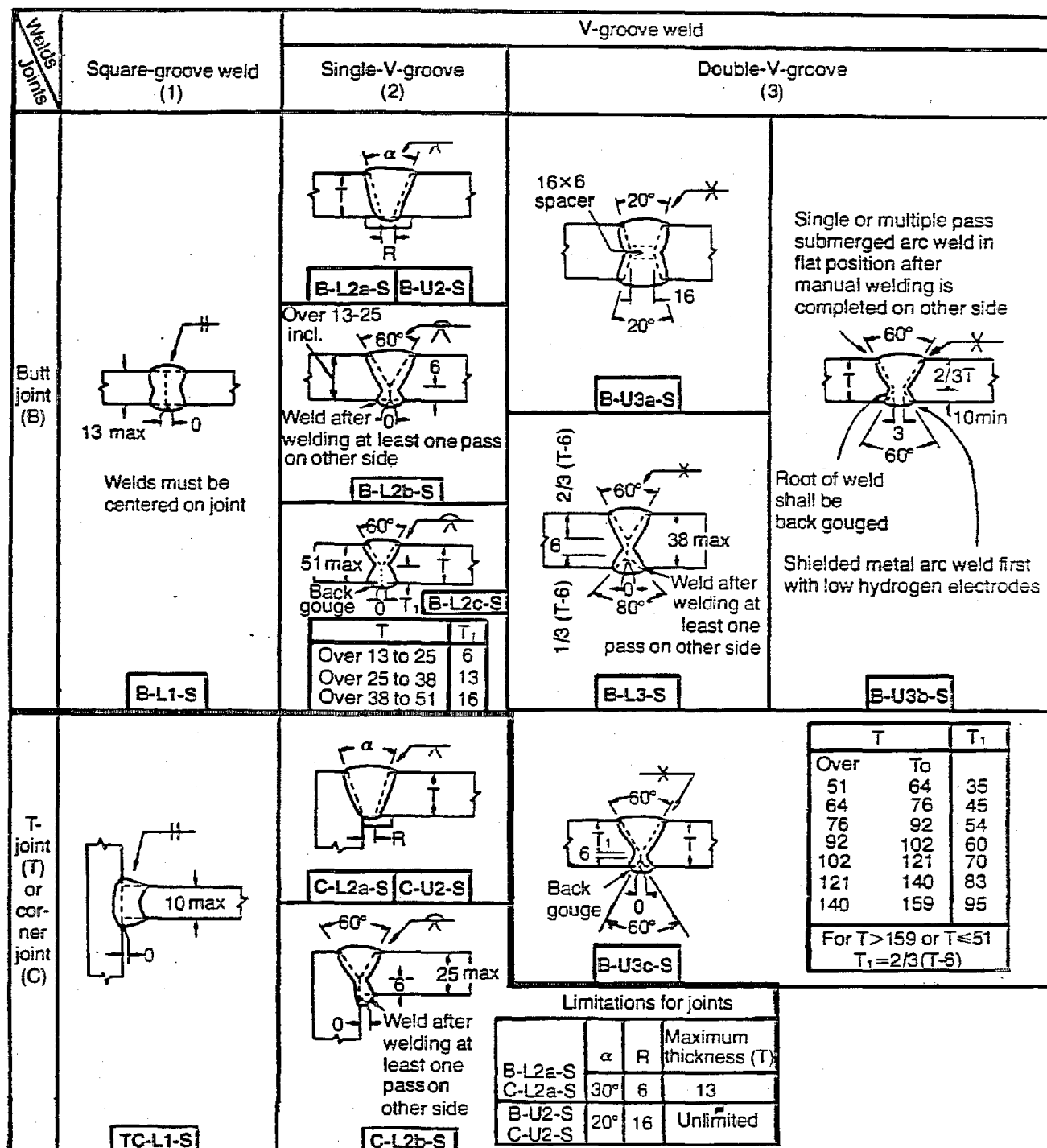
Notes:

1. Gauge the roots of joints without backing before welding the other side.
2. If fillet welds are used to reinforce groove welds in T- and corner joints, they shall be equal to T/4 welds equal to T/4 but not more than 10 mm. T is the thickness of the groove weld.
3. Refer to Table 10.4 for symbols.

*For corner joints, the outside groove preparation may be in either or both members, provided the basic groove configuration is not changed and adequate edge distance is maintained to support the welding operation without excessive edge melting.

mm	in.
3	1/8
6	1/4
10	3/8

Figure 10.5. Complete Joint Penetration Prequalified Shielded Metal Arc Welded Joints--Base Metal of Limited Thickness (L)
(Fig. 3.3.4.2.1, Ref. 13).



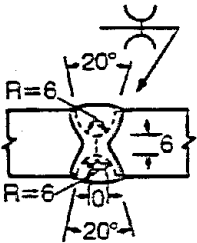
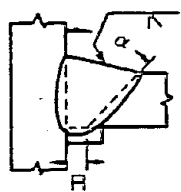
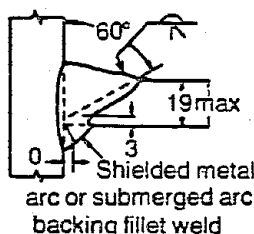
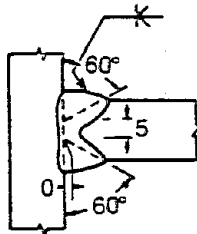
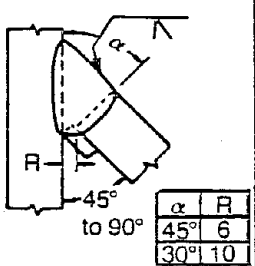
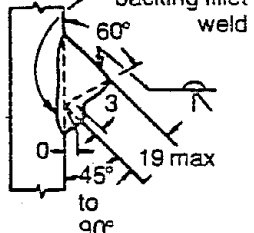
Notes:

All dimensions in millimeters except angles

- If fillet welds are used to reinforce groove welds in T- and corner joints, they shall be equal to T/4 but need not exceed 10 mm. Groove welds in T- and corner joints shall be reinforced with fillet welds equal to T/4 but not more than 10 mm. T is the thickness of the groove weld.
- Refer to Table 10.4 for symbols.

mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
3	1/8	16	5/8	45	1-3/4	64	2-1/2	92	3-5/8	140	5-1/2
6	1/4	25	1	51	2	70	2-3/4	95	3-3/4	152	6
10	3/8	35	1-3/8	54	2-1/8	76	3	102	4	159	6-1/4
13	1/2	38	1-1/2	60	2-3/8	83	3-1/4	121	4-3/4		

Figure 10.6. Complete Joint Penetration Prequalified Submerged Arc Welded Joints--Base Metal of Limited Thickness (L) and Unlimited Thickness (U). (Fig. 3.3.5.1, Ref. 13)

Welds Joints	Bevel-groove weld		U-groove weld
	Single-bevel-groove (4)	Double-bevel-groove (5)	Double-U-groove (7)
Butt joint (B)			 B-U7-S
T-joint (T) or corner joint (C)	 TC-U4a-S	 TC-L4a-S	 TC-U5-S
	 TC-U4b-S	 TC-L4b-S	

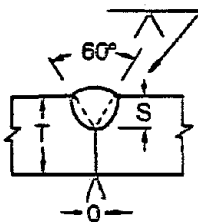
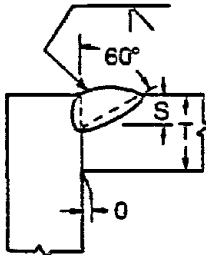
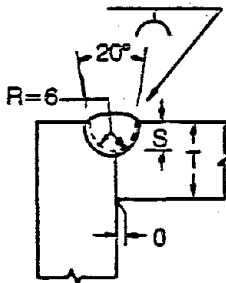
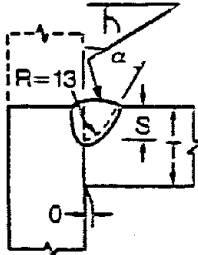
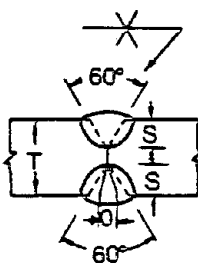
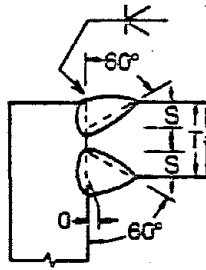
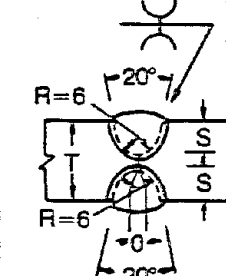
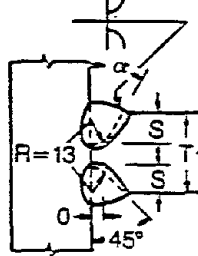
All dimensions in millimeters except angles

Notes:

1. If fillet welds are used to reinforce groove welds in T- and corner joints, they shall be equal to $T/4$ but not exceed 10 mm. Groove welds in T- and corner joints shall be reinforced with fillet welds equal to $T/4$ but not more than 10 mm. T is the thickness of the groove weld.
2. Refer to Table 10.4 for symbols.

mm	in.	mm	in.
3	1/8	10	3/8
5	3/16	19	3/4
6	1/4		

Figure 10.6 (Cont). Complete Joint Penetration Prequalified Submerged Arc Welded Joints--Base Metal of Limited Thickness (L) and Unlimited Thickness (U). (Fig. 3.3.5.1, Ref. 13)

Welds Joints		V-groove weld	Bevel-groove weld	U-groove weld	J-groove weld						
		Single-V-groove weld (2)	Single-bevel-groove weld (4)	Single-U-groove weld (6)	Single-J-groove weld (8)						
Butt (B), T-(T) or corner (C) joints	Minimum root face of joint shall be 6 mm				 <table border="1" data-bbox="1328 732 1476 827"><tr><th>Joint</th><th>α</th></tr><tr><td>C-P8-S</td><td>20°</td></tr><tr><td>T-P8-S</td><td>45°</td></tr></table>	Joint	α	C-P8-S	20°	T-P8-S	45°
		Joint	α								
		C-P8-S	20°								
		T-P8-S	45°								
Effective throat (E) = S*		Effective throat (E) = S*	Effective throat (E) = S*	Effective throat (E) = S*							
BC-P2-S		TC-P4-S	BC-P6-S	C-P8-S T-P8-S							
Double-V-groove weld (3)		Double-bevel-groove weld (5)	Double-U-groove weld (7)	Double-J-groove weld (9)							
				 <table border="1" data-bbox="1328 1391 1476 1487"><tr><th>Joint</th><th>α</th></tr><tr><td>C-P9-S</td><td>20°</td></tr><tr><td>T-P9-S</td><td>45°</td></tr></table>	Joint	α	C-P9-S	20°	T-P9-S	45°	
Joint	α										
C-P9-S	20°										
T-P9-S	45°										
Effective throat (E) = S*	Effective throat (E) = S*	Effective throat (E) = S*	Effective throat (E) = S*								
B-P3-S	TC-P5-S	B-P7-S	C-P9-S T-P9-S								

All dimensions in millimeters except angles

Note: Refer to Table 10.4 for symbols

*Minimum effective throat = T/6

mm	in.
6	1/4
13	1/2

Figure 10.7. Partial Joint Penetration (P) Prequalified Submerged Arc Welded Joints. (Fig. 3.3.5.1, Ref. 13)

Table 10.4 Legend for Figures 10.2 through 10.7

Symbols for joint types

- B - butt joint
- C - corner joint
- T - T-joint
- BC - butt or corner joint
- TC - T- or corner joint
- BTC - butt, T-, or corner joint

Symbols for base metal thickness and penetration

- L - limited thickness - complete joint penetration
- U - unlimited thickness - complete joint penetration
- P - partial joint penetration

Symbols for weld types

- 1 - square-groove
- 2 - single-V-groove
- 3 - double-V-groove
- 4 - single-bevel-groove
- 5 - double-bevel-groove
- 6 - single-U-groove
- 7 - double-U-groove
- 8 - single-U-groove
- 9 - double-J-groove

Symbols for welding processes if not shielded metal arc

- S - submerged arc welding
 - G - gas metal arc welding
 - F - flux cored arc welding
-

the statement of his or the Company's acceptance of the welder's qualification. The third approach provides for welder certification by radiographic examination of a test plate. Welding a grooved test plate of 3/8-inch thickness qualifies a welder or operator for any thickness fillet weld for those welding positions tested. To qualify for groove welds of unlimited thickness, the plates tested must be at least 1 inch thick, using a single-Vee groove as described in paragraph 6.19 [13]. The alloy group designations for various weld strength levels for which a welder must qualify are described in paragraph 6.18.2 [13]. Referring again to the fillet weld example, the welder could be qualified to make the fillet welds by either Option 1 or 2. Option 1 test is shown in Figure 6.23.1 [13]. It consists of a single fillet-welded T joint, 8 inches long on 1/2-inch plate which is sectioned for a macro-etch and a break test (paragraph 6.28.2 [13]). Acceptance for the test is provided in paragraph 6.29.2 [13]. Option 2 provides for making fillet welds into root-bend test specimens as shown in Figure 6.23.2 [13]. The two root-bend test specimens (Table 6.27.1 [13]), tested in one of the jigs shown in Figure 6.28.1 [13], must not exceed a 1/8-inch crack (or defect) on the convex surface of the U bend as required in paragraph 6.29 [13].

The position of welding is an essential variable for welder qualification. The welder must be tested and qualified for the placement and positioning of welding used in production. However, the more difficult positions identified in Figure 6.9.3 [13] for fillet welds also qualify the welder for the less difficult positions as summarized in Table 6.24 [13]. For example, the 3F plate-fillet position, which consists of a vertical weldment, will qualify the welder for flat (F) and horizontal (H), as well as vertical (V) fillet welding.

10.4 Procedure Qualification Testing and Testing Laboratories (Section 6, Parts B and C, [13])

It is common practice for smaller companies (who do not have their own test facilities) to send both their welder and procedure qualification test coupons to a commercial testing laboratory. Most major cities have testing laboratories capable of testing and reporting results needed for certification. In the event a procedure qualification test is required, because the desired joints or welding processes are not considered as

prequalified in the Standard, the use of a testing laboratory is very helpful. Mechanical tests are required for procedure qualification which involve both tensile and guided-bend testing as shown in Table 6.11.1.1, [13]. Removal and preparation of test specimens are presented in sufficient detail that any shop or laboratory can make them in accordance with Figures 6.11.1.3, (A) through (K) [13].

For typical explosion-proof enclosure construction, procedure qualification would not be necessary. On the other hand, where the flux-cored arc welding (FCAW) process is used for other than fillets, it would be necessary to qualify any groove welding procedure.

10.5 Inspection (Section 7, Part E [13])

The final item required by the Standard for a typical XP enclosure would be Part E, "Visual and Dimensional Inspection," [13]. Visual inspection is required in Table 5, "Weld Quality Assurance Requirements," for a Class V weld. Therefore, all of the visual acceptance criteria on pages 70 through 74 [13] apply for final weld surfaces.

Considerable added quality assurance measures can be provided during fabrication that are not mandatory in the Standard. Nondestructive and visual testing at intervals during welding can avert many of the conditions that produce defects. The quality of the root bead is important, as is the interbead cleaning and grinding preparations that are performed. To help ensure the soundness of the welds being made, it is recommended that an inspector be assigned to in-process as well as final weld inspection. Additional recommendations for providing Quality Assurance in the manufacture of explosion-proof enclosures are provided in Reference 14. Also, additional information and examples on the application of Welding Standard D14.4 to explosion-proof enclosures are provided in Appendix I of Reference 2.

11.0 BOLTED COVERS

Because the behavior of the bolts and cover are interdependent, an elastic analysis was performed, using the procedure developed in Reference 2, to obtain coupled solutions for bolt and cover stresses. Tabular results were generated for use by the designer in choosing appropriate cover thickness and bolt size. If the cover stresses exceed the material yield stress (and minor yielding of the cover is permissible), then the cover must be checked using the procedures in Chapters 5 and 6. A procedure is also given to establish the length of thread engagement. This procedure is not intended to supplant MSHA requirements, given in Chapter 3, but only to insure adequate thread engagement to fully develop the bolt.

11.1 Bolt and Cover Stresses

A procedure was developed in Reference 2 for calculating the behavior of bolted covers when loaded by internal static pressures. The procedure is based on a series solution to the problem, and computes deflections, forces and stresses in the bolts and cover for rectangular covers of arbitrary size and for arbitrary bolt spacing. Assumptions upon which the procedure is based are:

- (1) Linear elastic behavior
- (2) Cover bolted to a rigid structure
- (3) Bolt heads rotate with the cover plate
- (4) No shear deformations occur in the cover or bolts

Comparisons in Reference 2 showed reasonable agreement between the series solution and finite element results which included a more complete description of the enclosure than just the bolts and cover. Also, we duplicated the comparisons of Reference 2 in this work and found that even better agreement could be obtained by including more terms in the series solution. Calculations in this work were performed with 25 terms in the series as opposed to the 9-term solution used in Reference 2.

The procedure was programmed and a matrix of problems was solved to give results for a large number of different cover sizes, plate thicknesses, plate

aspect ratios, bolt spacing and bolt size. Results of the calculations, presented in terms of the maximum stresses in the bolts and cover, are given in Appendix A for steel covers and in Appendix B for aluminum covers.

Because allowable stresses in the bolts and cover vary, the designer must select the proper combination of cover thickness, bolt spacing and bolt size which gives bolt stresses closest to, but less than, his allowable. To assure that bolt stretch, which could increase the flange-to-cover gap, will not occur, bolt axial stresses should be less than the bolt yield (or proof) strength and the combination of the bending and axial stress (the maximum stress) should not exceed the bolt ultimate strength.

As mentioned previously, cover stresses can exceed the material yield strength, so long as the cover is checked and found to be adequate according to the procedures of Chapters 5 and 6. To analyze the cover as a panel, it is necessary to determine the edge moment developed in the cover by the bolts. This is given by the joint efficiency (analogous to the weld joint efficiency of Chapter 10), which is the ratio of the moment which can be reacted by the bolts to the fully plastic moment for the cover. Using the geometry of Figure 11.1, the joint efficiency is given by Equations 11.1 and 11.2.

$$E_j^a = \frac{8 F_y e_a N_a}{3 a h^2 \sigma_y} \quad (11.1)$$

$$E_j^b = \frac{8 F_y e_b N_b}{3 b h^2 \sigma_y} \quad (11.2)$$

where σ_y = cover material yield stress
 F_y = yield load for the bolt
 N_a = no. of bolts along side a
 N_b = no. of bolts along side b
 h = cover thickness

The only restriction on Equations 11.1 and 11.2 is that E_j cannot exceed 1.

Using the joint efficiencies calculated by Equations 11.1 and 11.2 in place of the weld joint efficiencies normally used in the panel analyses, the cover is now analyzed as a panel according to Chapters 5 and 6.

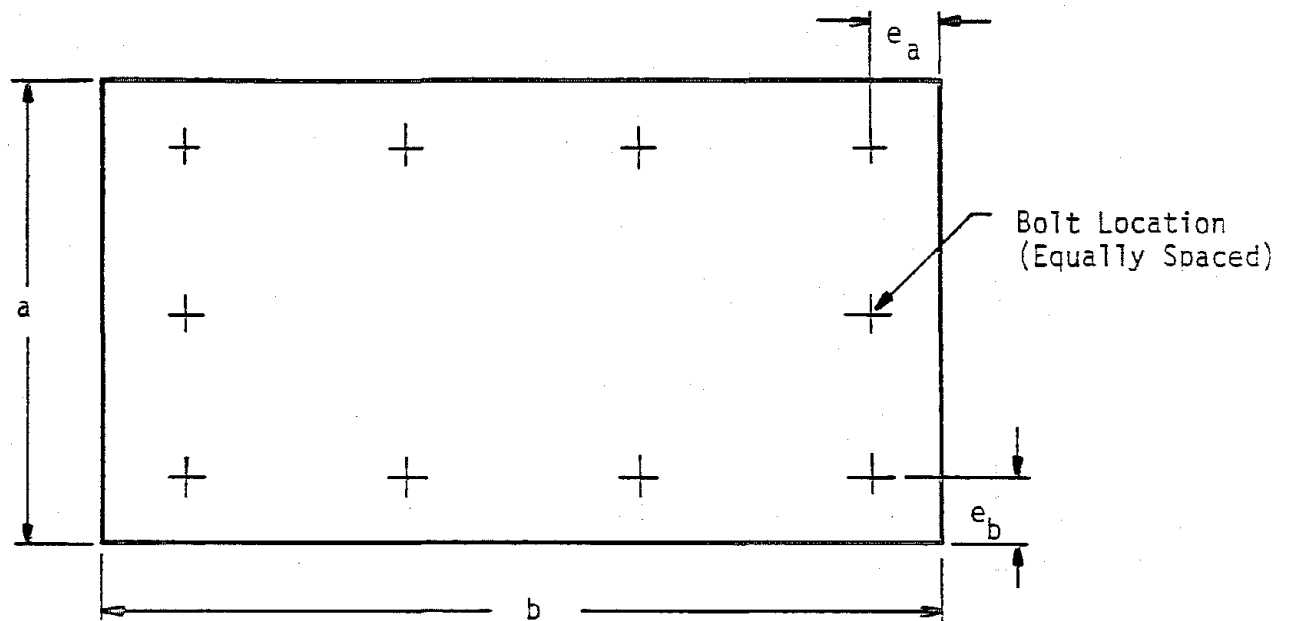


Figure 11.1 Cover and Bolt Geometry

11.2 Thread Engagement

The minimum length of thread engagement, required to develop the full strength of the bolts, is given in Reference 15. For convenience, the equations are repeated here; however, tables of bolt data are voluminous and so Reference 15 or a similar reference will be needed for these calculations.

When the tapped material (the flange) is as strong as the bolt, the minimum length of thread engagement is given by Equation 11.3.

$$L_e = \frac{2 A_t}{\pi K_n \text{MAX} \left[\frac{1}{2} + 0.57735n(E_s \text{MIN} - K_n \text{MAX}) \right]} \quad (11.3)$$

where A_t = bolt tensile stress area (in²)
 $K_n \text{MAX}$ = maximum minor diameter of the internal thread (in.)
 $E_s \text{MIN}$ = minimum pitch diameter of the external thread (in.)
 n = number of threads per inch

The bolt type and number of threads per inch, n , are specified by the designer. Class 1 (coarse, loose-fitting) threads must be used as specified by MSHA (see Chapter 3). The tensile stress area is given in Table 3 which begins on p. 1262 [15]; $K_n \text{MAX}$ and $E_s \text{MIN}$ are given in Table 4 which begins on p. 1276 [15].

If the tapped material is weaker than the bolt, the length of thread engagement is given by

$$L_e' = J \times L_e \quad (11.4)$$

where $J = \frac{A_s \times \text{tensile strength of bolt material}}{A_n \times \text{tensile strength of the tapped material}}$

$$A_s = \pi n L_e K_n \text{MAX} \left[\frac{1}{2n} + 0.57735 (E_s \text{MIN} - K_n \text{MAX}) \right] \quad (11.5)$$

$$A_n = \pi n L_e D_s \text{MIN} \left[\frac{1}{2n} + 0.57735 (D_s \text{MIN} - E_n \text{MAX}) \right]$$

The new variables D_{sMIN} , the minimum major diameter of the external thread (in.), and E_{nMAX} , the maximum pitch diameter of the internal thread (in.), are also given in Table 4 of Reference 15.

The length of thread engagement should be greater than the calculated value of L_e' . If this condition is not met, some allowance can be made if axial bolt stresses are low. Adjust L_e' according to Equation 11.6 and compare the adjusted value with the actual length of thread engagement.

$$L_{e' Adj.} = L_e' \cdot \frac{1.5 \sigma_{B_{AXIAL}}}{\sigma_{U_B}} \quad (11.6)$$

σ_U is the bolt tensile strength and, σ_{AXIAL} is the bolt axial stress from Appendix A or B. Equations (11.3), (11.4) and (11.6) are based on strength requirements only. If they are in conflict with the requirements of MSHA (Chapter 3) the requirements of MSHA must govern.

12.0 REINFORCEMENT AT PENETRATIONS

When penetrations for windows, cables, switches, etc., are placed through the structural boundary, reinforcement must be added around the penetration (hole) if stiffness and strength are not to be reduced. For enclosures, the criteria for reinforcement will be based upon maintaining the same enclosure strength, expressed in terms of the fully plastic hinge moment,

$$M_p = \sigma_y Z_p \quad (12.1)$$

where Z_p is the plastic section modulus. The plastic moment is used because the analysis of enclosure strength is based upon yield line (or limit analysis) methods.

Equations for symmetrical and unsymmetrical reinforcement around penetrations in flat plates are given in Figure 12.1. To develop the equations in Figure 12.1, the plastic moment for the reinforcing material (area = $2 W_R h_R$) was set equal to the plastic moment of the material removed (area = ch). For unsymmetrical reinforcement, the neutral axis was found for an effective width of " $2W_R$ " on either side of the hole. Note that for symmetrical reinforcement one of the dimensions of the reinforcement is chosen and the other is solved for. For unsymmetrical reinforcement, both must be chosen and the reinforcement then checked by solving for W_R . When reinforcing a penetration, all planes through the penetration should satisfy the equations of Figure 12.1.

As an alternative to the use of Figure 12.1, a conservative approach can be taken which requires no iteration procedure. It is based on equivalent tensile strengths* and always gives a conservative answer. For either symmetrical or unsymmetrical reinforcement, with an equal strength material having the geometry of Figure 12.1, the equations are:

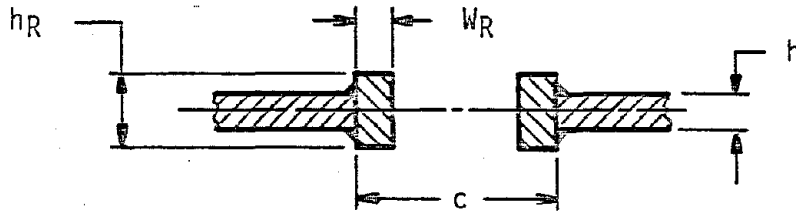
$$h_R = \frac{ch}{2W_R} \quad (12.2)$$

or

$$W_R = \frac{ch}{2h_R} \quad (12.3)$$

*sometimes called area replacement

Symmetrical Reinforcement:

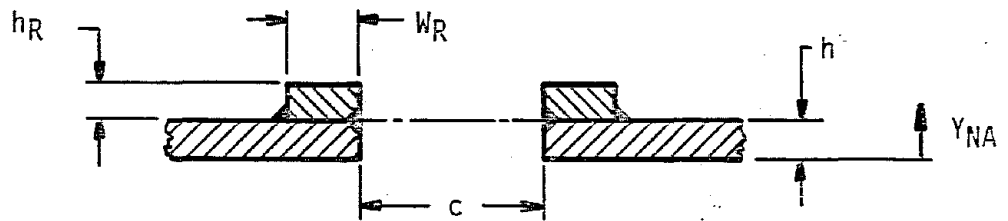


$$W_R = \frac{C}{2} \left(\frac{\sigma_{YP}}{\sigma_{YR}} \right) \left(\frac{h}{h_R} \right)^2$$

or

$$h_R = h \left(\frac{\sigma_{YP}}{\sigma_{YR}} \right) \left(\frac{C}{2W_R} \right)$$

Unsymmetrical Reinforcement:



$$Y_{NA} = \frac{h}{2} \left[\frac{2 + 2(h_R/h) + (h_R/h)^2}{2 + (h_R/h)} \right]$$

$$W_R = \frac{c(\sigma_{YP}/\sigma_{YR})}{8(h_R/h) + 4(h_R/h)^2 - 8 \left(\frac{Y_{NA} h_R}{h^2} \right)}$$

where σ_{YP} = yield stress of the plate material

where σ_{YR} = yield stress of the reinforcement material

Figure 12.1. Reinforcement Around Penetrations Through Flat Plates.

If the reinforcement and plate materials have unequal strengths, the equations become:

$$h_R = \left(\frac{\sigma_{yP}}{\sigma_{yR}} \right) \frac{ch}{2W_R} \quad (12.4)$$

$$W_R = \left(\frac{\sigma_{yP}}{\sigma_{yR}} \right) \frac{ch}{2h_R} \quad (12.5)$$

Equations (12.2) through (12.5) can be used in lieu of Figure 12.1 or to give initial estimates for unsymmetrical reinforcement. The total area of the reinforcement given by Equations (12.2) through (12.5) should always equal or exceed that determined from Figure 12.1. Also, Equations (12.2) through (12.5) are the proper equations for reinforcing penetrations in cylinders and spheres.

The geometry of Figure 12.1 is for simple reinforcement, and should apply to most penetrations found in enclosures. For more complex reinforcement geometries, the designer must compute and equate the plastic moment of the reinforcement material to that of the area removed. Alternately, he can compute and equate the allowable tensile forces, $\sigma_y A$, to obtain equations equivalent to (12.2) through (12.5). Methods for computing the plastic section modulus are given in texts such as Reference 16.

All penetrations in enclosures do not have to be reinforced (although it is recommended) if strength reductions are accounted for when sizing the enclosure panels in Chapters 5 and 6. If the penetration is not reinforced according to the procedures in this chapter, then a strength reduction factor is computed for section's through the penetration which are parallel to the sides a and b of the panel (Figure 12.2). As for the reinforcement, equations for strength reduction are based upon the plastic moment of the section. Equations 12.6 give the strength reduction factors for symmetrical reinforcement.

$$\begin{aligned} STRF_a &= 1 - \frac{c_o}{a} + \left(\frac{\sigma_{yR}}{\sigma_{yP}} \right) \left(\frac{2W_R}{a} \right) \left(\frac{h_R}{h} \right)^2 \\ STRF_b &= 1 - \frac{c_o}{b} + \left(\frac{\sigma_{yR}}{\sigma_{yP}} \right) \left(\frac{2W_R}{b} \right) \left(\frac{h_R}{h} \right)^2 \end{aligned} \quad (12.6)$$

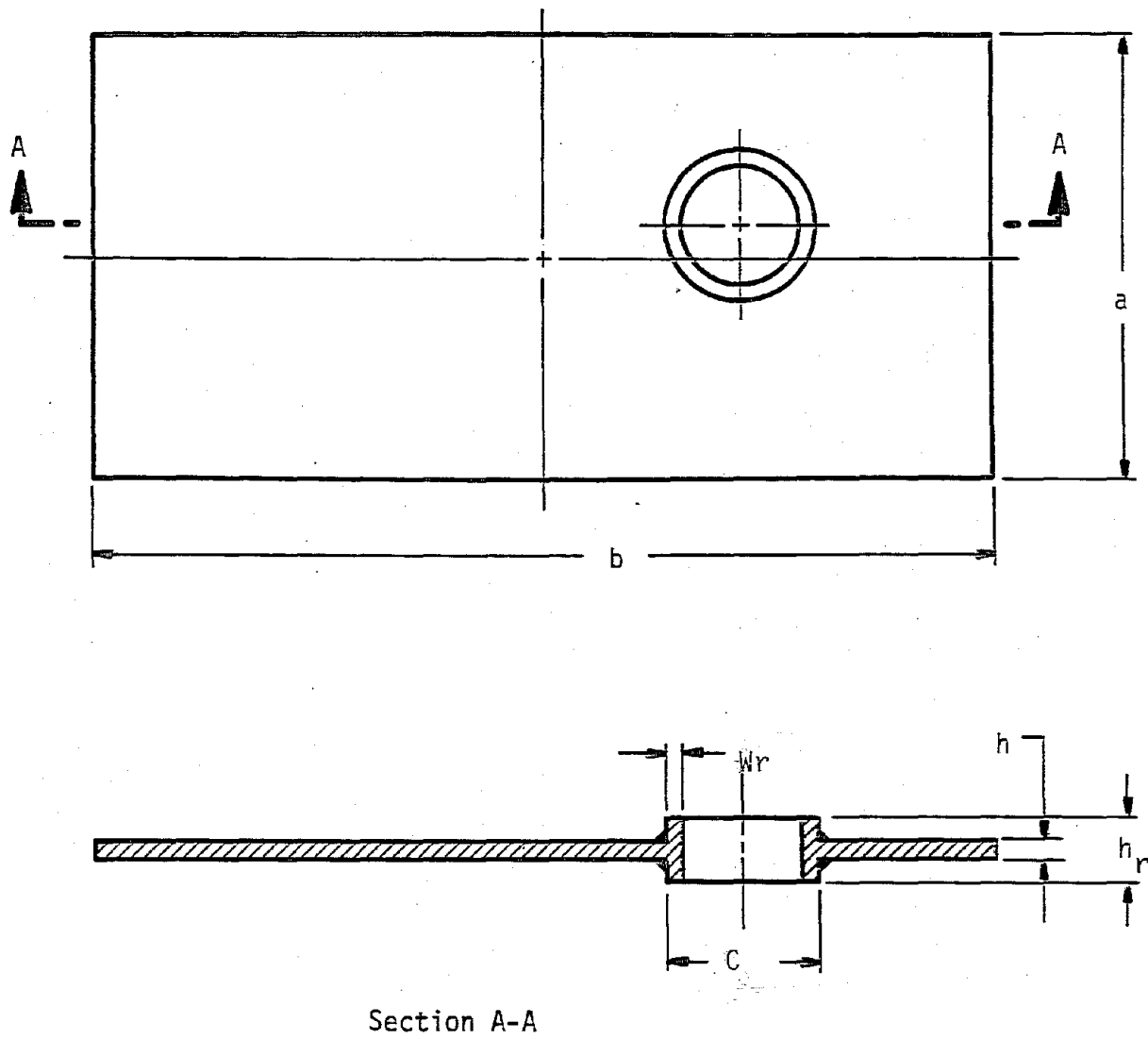


Figure 12.2 Geometry of a Penetration

where σ_{yR} = yield strength of the reinforcement

σ_{yP} = yield strength of the plate

Strength reduction factors for more complex reinforcement must be calculated by hand or estimated by using an equivalent W_R .

The above factors should be used in the panel strength calculations (Chapters 5 and 6) if they meet the following two conditions:

- (1) They are less than 1.0
- (2) The penetration lies near the plate centerline.

As an example, if $STRF_b$ of the plate in Figure 12.2 was less than 1, it would be used in the analysis of the plate because it lies near the centerline which is parallel to side b; however, $STRF_a$ would not be used.

A strength reduction factor is not easily adapted to the equation for circular plates (Equation 5.3). It is recommended that penetrations in circular plates be fully reinforced.

13.0 MATERIALS FOR FABRICATION

Enclosures shall be fabricated only from materials suited for the operational environment encountered in underground mines. Environmental conditions in the mine may include:

- o temperatures up to 302°F
- o high humidity
- o contact with hydraulic oils, water spray, mine acid water and coal dust
- o impact by rock falls, hand tools or collisions with mining machinery
- o internal and external methane gas explosions

The suitability of a material for this service is based, either on documented extensive past experience, or on exhaustive evaluations in a simulated mine environment.

Six basic categories of materials are used for enclosure fabrication. They are:

1. Metals
2. Glasses
3. Plastics
4. Sealants and Adhesives
5. Gasket Materials
6. Packing gland materials

This Guide addresses materials in categories 1-5 because they directly form or indirectly affect the strength of the enclosure. Materials in categories 4 and 5, for example, are not part of the structural boundary but are used in window mounting and so are important to window performance. Packing materials in category 6 are used for sealing at electrical penetrations. They do not affect enclosure strength and thus are not addressed in the Guide.

Included in this chapter are some suitable materials for enclosure fabrication which have gained acceptability, primarily through years of satisfactory service and secondarily by laboratory testing. By far the largest selections of different materials are available for metals and

glasses. The materials included here are only a representative sample. Fewer materials have been accepted by MSHA in categories 3, 4 and 5 and the number of suitable materials is much smaller.

New materials for enclosure fabrication must be approved by MSHA. These materials should be subjected to rigorous laboratory tests which simulate the mine environment. Such tests, for materials in categories 2 through 5, are given in Appendices C through G of this Guide. If accepted by MSHA they could form the basis for the qualification of new materials for enclosure fabrication.

13.1 Metals

Steel and aluminum in wrought and cast form have proven themselves by a long history of successful use in XP enclosures. These materials are affected only slightly by enclosure operating temperatures, and steels can be protected from corrosion by suitable coatings. A list of all acceptable steels and aluminums would be excessively long; thus, Tables 13.1, and 13.2 give only a limited selection of steels and aluminums which are suitable for enclosure fabrication.

Most steels and aluminum can be accepted for XP enclosures and Tables 13.1 and 13.2 can be added to as needed; however, if the materials are assembled by welding, some caution should be exercised. Cast metals require special welding techniques, such as preheating, etc., and high carbon content steels (greater than 30 points) should be avoided.

13.2 Glasses

The chemical composition, casting process and thermal treatment determine the physical, chemical, optical and electrical properties of glass. Because of a very complex relationship between these variables, no one single glass composition, casting process, or thermal treatment is considered superior to others. Thus, the designer is free to select a combination of fabrication parameters that matches best his specific set of product requirements.

The primary advantages of glass are its ability to retain its physical and optical properties under high ambient temperature, ultraviolet radiation,

Table 13.1 Acceptable Steels

ANSI ASTM Material Designation	Yield* Strength (KSI)	Elastic** Modulus (KSI)	Poisson's Ratio	Density (lb/in ³)	Coefficient Of Thermal Expansion (in/in/°F)
A-36	36	29,000	.33	.286	6.9×10^{-6}
AISI 1025 Carbon Steel	36	29,000	.33	.284	7.0×10^{-6}
SA-516 Grade 60	32	29,000	.33	.286	6.6×10^{-6}
SA-573 Grade 65	35	29,000	.33	.286	6.6×10^{-6}
AISI 304 Stainless Steel Annealed	35	29,000	.33	.286	8.7×10^{-6}
AISI 410 Stainless Steel	35	29,000	.33	.286	8.7×10^{-6}
ASTM A48 Cast Iron Grade 30	30	29,000	.33	.26	6.5×10^{-6}

*Reduce by 10% @ 300°F

**Reduce by 5% @ 300°F

Table 13.2 Acceptable Aluminums

Material Designation	Yield* Strength (KSI)	Elastic** Modulus (KSI)	Poisson's Ratio	Density (lb/in ³)	Linear Coefficient Of Thermal Expansion (in/in/°F)
2024-T351	42	10,700	.34	0.100	13.1×10^{-6}
5083-H32 (H116)	30	10,200	.33e	0.096	13.2×10^{-6}
5456-H111	33	10,200	.33e	0.096	13.1×10^{-6}
6061-T6 (T651)	40	10,700	.34	0.100	14.3×10^{-6}
A201.0 T4 Cast AL (Formerly ASTM. CQ51A)	31	10,300	.33	0.101	13.0×10^{-6}
A319.0 T6 Cast AL (Formerly ASTM SC64D)	24	10,700	.33	0.100	13.0×10^{-6}
A413.0 Cast AL (Formerly ASTM 413.0)	19	10,300	.33	0.101	13.0×10^{-6}

*Reduce by 10% @ 300°F

**Reduce by 5% @ 300°F

and humidity for a very long time; resist surface abrasion by rock particles; and to tolerate immersion in aqueous and organic solvents without initiation of stress corrosion cracking. For this reason, glass windows can tolerate 100% relative humidity, temperature of 400°F, intense ultraviolet radiation and continuous or intermittent immersion in basic or acidic water, or organic solvents for indefinite periods of time.

The protection against fracture initiated by point contact is usually accomplished by insertion of gaskets between the glass and metallic components of the seat assembly. Protection against breakage by impact is generally provided by an external shield in the form of a cage or plastic envelope, or by precompressing the glass window surfaces with thermal tempering or chemical ion exchange.

Some glasses which are suitable for enclosure windows are:

- borosilicate glasses (PYREX)*
- soda lime glasses
- silica glasses

They all have been used successfully for the fabrication of pressure-resistant windows and in enclosures for use underground. Typical properties for these glasses are given in Table 13.3. Properties for the specific glass composition should be used in the design calculations.

Any unapproved glass composition selected for fabrication of windows must be first qualified for window service. The material qualification procedure consists of testing to destruction, either material test specimens in standard test fixtures, or whole windows in custom-made mountings, according to test procedures of Appendix C. Only if the measured flexural stresses at the moment of fracture exceed the specified minimum values of Appendix C is the material considered qualified according to the recommendations of this Guide. MSHA is the final authority on acceptable materials for mining use.

*PYREX is a trade name.

Table 13.3 Glasses and Plastics

Material Designation	Tensile Yield Strength (KSI)			Elastic Modulus (KSI)			Poisson's Ratio	Density (lb/in ³)	Coefficient of Thermal Expansion (in/in/°F)		
	RT	150	240	300°F	RT	150				240	300°F
Soda Lime Glass				6.6				10,000	0.24	0.0914	4.8 x 10 ⁻⁶
Borosilicate Glass				6.3				9,100	0.24	0.0806	1.8 x 10 ⁻⁶
Silica Glass				8.0 (abraded) (polished)				10,750	0.17	0.079	0.5 x 10 ⁻⁶
Lexan 101	9.0	7.9	6.4	-	345	304	240	-	0.38	0.0433	66 x 10 ⁻⁶
Merlon 3113	9.2	8.0	6.6	-	335	302	220	-	0.38	0.0433	66 x 10 ⁻⁶

13.3 Plastics

High temperature, humidity, intensive ultraviolet radiation, and petroleum based hydraulic oils and lubricants may degrade the mechanical properties of plastic windows in explosion-proof enclosures. Some plastics will deteriorate in enclosure service faster than others, but even the most resistant ones will age sufficiently to mandate their removal from service as windows in less than 10 years. For this reason, plastics must have proven themselves by years of satisfactory service in the mine environment or by a thorough engineering evaluation.

Polycarbonate (PC) plastics appear to have the proper combination of mechanical, chemical, and optical properties which make them desirable for service as windows in XP enclosures. Although PC plastics have been utilized for fabrication of windows only recently, relative to metals and glass, their performance in service has been, to date, satisfactory.

The major advantage of PC plastics, which led to their utilization in windows for XP enclosures, is their superior resistance to point impact in thin cross sections. The major shortcoming of PC plastics is the deterioration of structural properties under UV radiation, continuous service at temperatures above 240°F, and contact with basic aqueous and organic solutions. Some of these negative features of material are compensated for either during design, fabrication, or operation of the window by adding a UV stabilizer to plastic, limiting the design temperature of the window to 240°F, preventing contact between undesirable fluids and the window, and by scheduled replacement of the windows at regular intervals.

Properties of two PC plastics which are suitable for use in enclosure fabrication are given in Table 13.3, presented previously. Both are UV stabilized. Tests by Parr, et al., [17] on LEXAN 101 showed only minor deterioration by UV only over a two-year period. The major factors which affected the properties of LEXAN 101 were elevated temperatures and some lubricating oils.

Tests with lubricating oils were not specific as to oil contents; however, they showed rapid deterioration of LEXAN 101 by one glycol and less severe but measurable deterioration by three inverts. One synthetic and one invert had no measurable effect on LEXAN 101. Clearly, exposure to the wrong lubricants can rapidly degrade PC plastic, but compatible lubricants are

available. Additional testing is recommended to aid in the selection of compatible lubricants when PC plastics are utilized on the mining machine.

The effect of temperature on PC plastics, as determined by Parr, et al., [17] is summarized in Table 13.4.

Table 13.4 Strength Reduction in PC Plastics Caused by Continuous Exposure at Elevated Temperatures

Service Temp. (°F)	Strength Reduction Factor	Suggested Service Life (YRS)
180°F	0.70	4
240°F	0.49	2

Strength degradation was measured by IZOD impact tests on specimens cut from environmentally exposed lenses. The reduction in IZOD impact toughness has been taken as an indication of the corresponding reduction in strength. Tests were performed for durations up to 36 months. The data for 180°F have been extrapolated to a four-year service life because the degradation in the PC plastic had stabilized. At 240°F, degradation of the PC plastic appeared to increase at about two years. The strength reduction factors in Table 12.4 are applied to the short-term design stress. The short-term design stress for plastics is to be taken as one-half of the yield strength at the in-service operating temperature.

For other plastics that are not now accepted by MSHA for use in enclosures, the qualification procedure of Appendix D is proposed. Qualification for any chosen formulation of plastic material consists of submitting coupons of that material formulation to test procedures of Appendix D. The data generated by these procedures serve, together with an appropriate safety factor, as the basis for design of windows from that material plastic formulation. A material quality assurance program for plastics is also proposed (Appendix E).

The objective of the material quality assurance test program is to compare the product of any plastic fabricator to the performance standard established for the particular family of plastics by test procedures of Appendix D. The quality assurance test program requires fewer tests than

initial qualification of the plastic formulation according to Appendix D. Further, a plastic material utilized in the production of windows need not be resubmitted to test procedures of Appendix E so long as the following requirements are being met by the plastic windows.

a. The plastic material formulation has been submitted at least once to test procedures of Appendix E, has met the requirements of Appendix D, and the certified results of these tests are on file at the fabricator of windows.

b. The material formulation and the producer of the plastic product are still the same as when the material formulation was originally qualified by test procedures of Appendix E and certified traceability documents are on file at the fabricator of windows.

Changes in material formulation, or substitution of one producer for another shall necessitate submission of the plastic to test procedures of Appendix E, and only after the material meets the requirements of Appendix D can future lots of this plastic formulation supplied by the same plastic producer be approved for fabrication of windows without resubmission of the material to the test procedures.

13.4 Adhesives and Sealants

Only epoxy and RTV are used extensively as sealants and adhesives in XP enclosures. Of the two, RTV is preferred if operating temperatures are high (between 150°F and 302°F). Limited tests on epoxies [17] have produced inconsistent values of bond strength after exposure to temperatures up to 302°F. Further, thermally induced stresses in enclosures have been shown to be higher with epoxy sealant than with RTV [12]. Thus, while either sealant is acceptable, by virtue of their past use, if operating temperatures are to be above 150°F, epoxy should be avoided.

Table 13.5 gives mechanical and thermal properties for one RTV and one epoxy. Of the epoxies tested in Reference 17, this epoxy produced the most consistent results.

The procedures of Appendix F are suggested for the qualification of adhesives and sealants which are not already approved by MSHA for use in enclosures. This procedure must be approved by MSHA, and MSHA grants the final approval on all new materials.

Table 13.5 Adhesives and Sealants

Material Designation	Yield Strength (KSI)				Elastic Modulus (KSI)				Poisson's Ratio	Density (lb/in ³)	Linear Coefficient of Thermal Expansion (in/in/°F)
	RT	150	240	300°F	RT	150	240	300°F			
HYSOJ 934 Epoxy	10.0	8.0	6.9	-	300	-	-	100	0.45	0.040	106×10^{-6}
GE108 RTV	0.050	-	-	-	0.190	-	-	-	0.49e	0.039	150×10^{-6}

13.5 Gaskets

Gasket materials are used to compensate for irregularities which may occur between the lens and the rigid metal seat in the enclosure. High points on a rigid metal seat can fracture a glass lens under the precompression of assembly or be the initiation site for subsequent failure under in-service loading.

Only one gasket material, lead, is now accepted by MSHA for use with glass, when the gasket forms part of the flame arresting path. Properties for lead are:

Yield strength (ksi):	8
Elastic Modulus (psi):	2×10^6
Poisson's Ratio:	0.45
Density (lb/in ³):	0.41
Thermal Expansion Coefficient (in/in/°F):	16.3×10^{-6}

A qualification procedure for elastomeric gasket materials is proposed in Appendix F. The procedure has not yet been approved by MSHA. Further, unless MSHA approves the use of elastomeric materials as part of the flame path, a separate and acceptable flame path must be provided.

14.0 EXAMPLE DESIGN PROBLEMS

Three examples are given in this chapter to demonstrate the use of the Guide. The first example is a rectangular enclosure, which operates at near ambient temperature and contains one window in the cover for viewing an internal meter. The second example is a small cylindrical enclosure with two penetrations through the cylindrical wall. The last example is an irregular shaped enclosure cover which contains one window and will operate at service temperatures of about 275°F. These examples are not intended to be typical of actual enclosures but are for demonstration only.

14.1 Rectangular Enclosure

14.1.1 Design Calculations

Geometry--Internal dimensions of the enclosure are given in Figure 14.1. Detailed dimensions will be established by analysis.

Internal Arrangement--The enclosure forms one large compartment with equipment occupying about 30% of the internal volume. No compartmentation occurs as a result of the placement of the equipment, but a lot of small irregular components could act as turbulence generators.

Materials (Ch. 13)--The enclosure sides, bottom and the flange for cover attachment are to be fabricated of AISI 1025 carbon steel. The cover will be 6061-T6 aluminum and the window will be LEXAN 101. Chapter 13 lists these as suitable materials for enclosure fabrication and gives their mechanical and thermal properties.

Bolts--Grade 5 bolts with Class I UNC threads will be used for the cover. Bolt allowable stresses are:

$$\sigma_y = 85,000 \text{ psi}$$

$$\sigma_u = 120,000 \text{ psi}$$

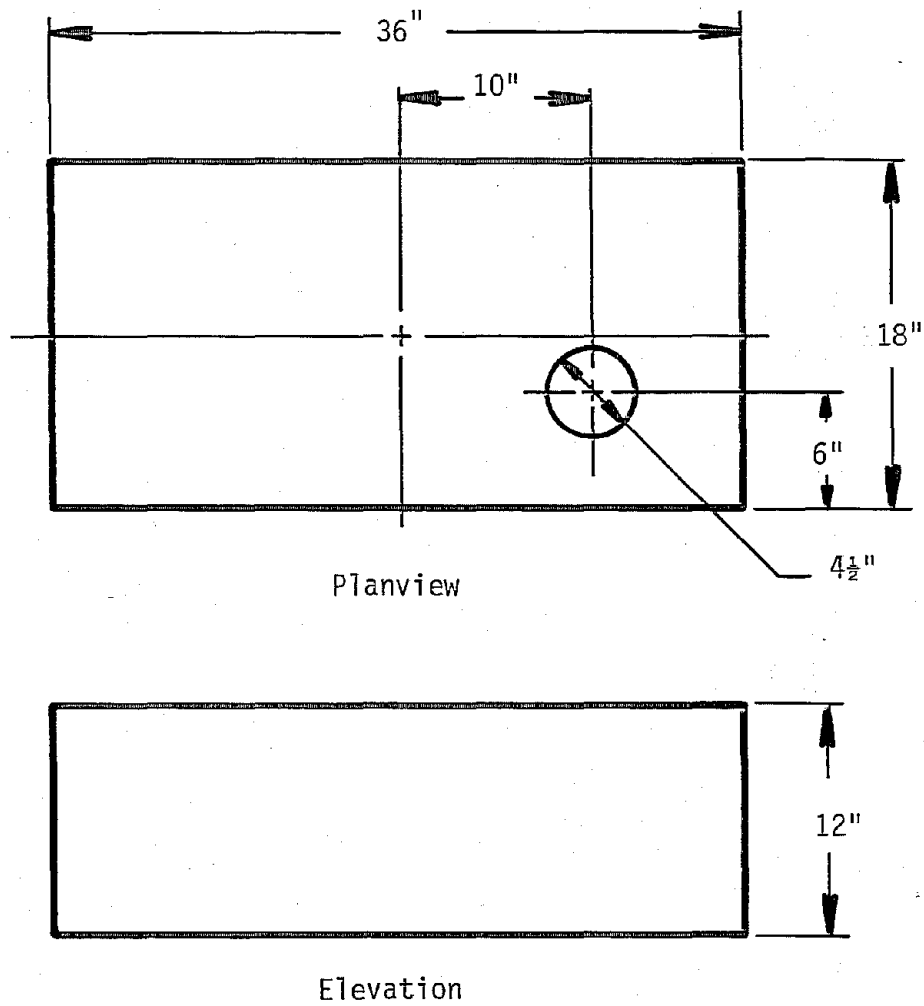


Figure 14.1. Internal Dimensions and Window Location for Rectangular Enclosure

MSHA Requirements (Ch. 3)--Because of its size, the enclosure falls into the large volume category. Dimensional constraints on the enclosure are:

minimum wall thickness	0.25 in.
minimum flange thickness	0.50 in.
minimum cover thickness	0.50 in.
minimum joint width	1 in.
maximum joint clearance	0.004 in.
maximum bolt spacing	6 in.
minimum bolt diameter	0.375 in.
minimum thread engagement	0.375 in.
maximum diametrical clearance	
between cover hole and bolt	0.0625 in.
minimum clearance, bolt hole to enclosure interior	0.4375 in.

Other MSHA requirements are covered in the design procedures of the Guide.

Design Pressures (Ch. 4)--The design static pressure for the enclosure is 150 psig. Pressure piling is not expected in the enclosure so the dynamic design pressure is 100 psig. Pressure piling is not expected because the enclosure is not too long, relative to its cross sectional dimensions, is not divided into compartments, either by interior walls or by the arrangement of the equipment, and obstacles in the compartment (potential turbulence generators) are not normally sufficient to cause pressure piling. The estimated minimum rise time of the dynamic pressure is given by Equation 4.5 as:

$$t_{\text{rmin}} = 21 \sqrt[3]{V} = 21 \sqrt[3]{(3 \text{ ft})(1.5 \text{ ft})(1 \text{ ft})} \\ = 34.7 \text{ msec}$$

Weld Joint Design (Ch. 10)--Class IV fillet welds will be used for fabrication of the enclosure. As shown in Figure 10.1, these joints require no special weld joint preparation and provide 80% static joint efficiency and 40% dynamic joint efficiency. Inspection requirements, specified in Table 10.1, call for visual and dimensional checks. The enclosure will be fabricated by rolling a

plate to form the 36 in. by 12 in. sides and the bottom of the structure. End panels and the flange for cover attachment will be welded to the rolled plate.

Design of Side and Bottom Panels--Panel thicknesses are first determined for the static design pressure and then checked for the dynamic pressures. This order is followed because an initial thickness is needed for the dynamic analysis so that the fundamental period of the panel and the dynamic load factor can be calculated.

Static Pressure (Ch. 5)--Panel thicknesses are calculated using Equation 5.2 and Table 5.1.

Bottom panel:

$$a/b = 18/36 = 0.5$$

$$c = 1.5 \dots \dots \dots \text{from Table 5.1}$$

$$E_j^a = 0.8 \dots \dots \dots \text{for 80\% static efficiency}$$

$$E_j^b = 1.0 \dots \dots \dots \text{for a rolled joint, Table 5.1}$$

$$STRF_a = STRF_b = 1.0 \dots \dots \dots \text{for no penetrations, Table 5.1}$$

$$\sigma_y = 36,000 \text{ psi} \dots \dots \dots \text{from Table 13.1}$$

$$h = \left[\frac{150(36)(18)}{3(36,000)[1.0 + 0.8 + 1.5(1.0 + 1.0)]} \right]^{1/2} \dots \dots \text{from Equation 5.2}$$

$$= 0.433 \text{ inch}$$

Choose a 1/2-inch plate.

Side panels: The side panels will be formed from the same plate as the bottom panel (rolled plate). The maximum thickness of either the side or bottom panel will set the plate thickness.

$$a/b = 12/36 = 0.33$$

$$c = 1.5 \dots \dots \dots \text{from Table 5.1}$$

$$E_j^a = 0.80 \dots \dots \dots \text{for 80\% joint efficiency}$$

$$E_j^b = 0.80 \dots \dots \dots \text{minimum value for weld at flange joint}$$

$$\text{STRF}_a = \text{STRF}_b = 1.0 \dots \dots \dots \text{for no penetrations, Table 5.1}$$

$$h = \left[\frac{150(36)(12)}{3(36,000)[1.0 + 0.8 + 1.5(1.0 + 1.0)]} \right]^{1/2} \dots \text{from Equation 5.2}$$

$$= 0.35 < 0.500, \quad \text{o.k.}$$

End panels:

$$a/b = 12/18 = 0.67$$

$$c = 1.21 \dots \dots \dots \text{from Table 5.1}$$

$$E_j^a = E_j^b = 0.80 \dots \dots \dots \text{for 80\% joint efficiency}$$

$$\text{STRF}_a = \text{STRF}_b = 1.0 \dots \dots \dots \text{for no penetrations, Table 5.1}$$

$$h = \left[\frac{150(18)(12)}{3(36,000)[1.0 + 0.8 + 1.2(1.0 + 0.8)]} \right]^{1/2} \dots \text{from Equation 5.2}$$

$$= 0.275 \text{ in}$$

Choose a 3/8-inch plate.

Dynamic Pressure (Ch. 6)--An equivalent static pressure is determined from Equation 6.3, and the procedures of Chapter 5 are used (as for the static pressure) to determine plate thickness. To compute the dynamic

load factor, DLF, we must first compute the plate fundamental frequency from the data in Table 6.1.

Bottom panel: $b/a = 36/18 = 2.0$

$$\omega b^2 \sqrt{\rho h/D} = 104.3 \dots \text{interpolation from Table 6.1, case 5}$$

$$\rho = 0.284 \text{ lb/in}^3 \dots \text{from Table 13.1 (AISI 1025)}$$

$$E = 29 \times 10^6 \text{ psi} \dots \text{from Table 13.1}$$

$$\nu = 0.33 \dots \text{from Table 13.1}$$

$$h = 0.500 \text{ in} \dots \text{for static pressure}$$

$$D = \frac{Eh^3}{12(1-\nu)} = \frac{(29 \times 10^6)(0.500)^3}{12(1-.33)} = 339,000$$

$$\omega = \frac{104.3}{(36)^2 \left[\frac{(.284/386)(.500)}{339,000} \right]^{1/2}} = 2443 \text{ 1/sec}^2$$

$$T = 2\pi/\omega = 2.57 \text{ msec}$$

$$\frac{t_{r_{\min}}}{T} = \frac{34.7 \text{ msec}}{2.57 \text{ msec}} = 13.49$$

$$(DLF) \approx 1 + \frac{1}{2\pi(13.49)} = 1.012 \quad \text{from Equation 6.1}$$

$$P_{EQ} = 100 \text{ psi} \times 1.012 \times 1.62 \dots \text{from Equation 6.3}$$

$$= 164 \text{ psig}$$

$$c = 1.5 \dots \text{from Table 5.1 (as for static pressure analysis)}$$

$$E_j^a = 0.40 \dots \text{for 40\% dynamic joint efficiency, Figure 10.1}$$

$$E_j^b = 1.0 \dots \text{for bend joint, Table 5.1}$$

$$\text{STRF}_a = \text{STRF}_b = 1.0 \dots \text{for no penetrations, Table 5.1}$$

$$h = \left[\frac{(164)(36)(18)}{3(36,000)[1.0 + .40 + 1.5(1.0 + 1.0)]} \right]^{1/2} \dots \text{from Equation 5.2}$$

$$= 0.47 \text{ in.} < 0.50$$

The plate thickness chosen for static pressure is adequate.

Side panels: Same as bottom panel because they are formed from the same sheet

End panels:

$$b/a = 18/12 = 1.5$$

$$\omega b \sqrt{\rho h/D} = 32.08 \dots \text{from Table 6.1, Case 1}$$

ρ , E and ν , are same as for the bottom panel

$$h = 0.375 \text{ inch} \dots \text{for static pressure}$$

$$D = \frac{Eh^3}{12(1-\nu^2)} = \frac{(29 \times 10^6)(.375)^3}{12[1-.33]^2} = 143,016$$

$$\omega = \frac{32.08}{(18)^2 \left[\frac{(.284/386)(.375)}{143,016} \right]^{1/2}} = 2254 \text{ 1/sec}$$

$$T = 2\pi/\omega = 2.79 \text{ msec}$$

$$\frac{t_{r_{\min}}}{T} = \frac{34.7}{2.79} = 12.45$$

$$(DLF) \approx 1 + \frac{1}{2\pi(12.45)} = 1.013.....\text{from Equation 6.1}$$

$$P_{EQ} = 100 \times 1.013 \times 1.62.....\text{from Equation 6.3}$$

$$= 164 \text{ psig}$$

$$c = 1.21.....\text{from Table 5.1 (as for static pressure analysis)}$$

$$E_j^a = E_j^b = 0.40.....\text{for 40\% dynamic weld joint efficiency}$$

$$STRF_a = STRF_b = 1.0.....\text{for no penetrations}$$

$$h = \left[\frac{164(18)(12)}{3(36,000)[1.0 + .4 + 1.21(1.0 + .4)]} \right]^{1/2} \quad \text{from Equation 5.2}$$

$$= 0.34 \text{ inch}$$

Therefore, the plate chosen for static loads is adequate.

Cover Design (Ch. 11)--Cover design is based on the data of Appendix B for aluminum covers. Thread engagement length is computed from the equations of Chapter 11.

Cover Thickness and Bolt Diameter--To use the tabulated data, the following parameters are needed:

Cover Area

Cover aspect ratio, b/a

Cover yield strength

Bolt yield strength

Bolt ultimate strength

To estimate the cover area, start with the internal dimensions of the enclosure and add space for the bolts as shown in Figure 14-2. If 3/4-

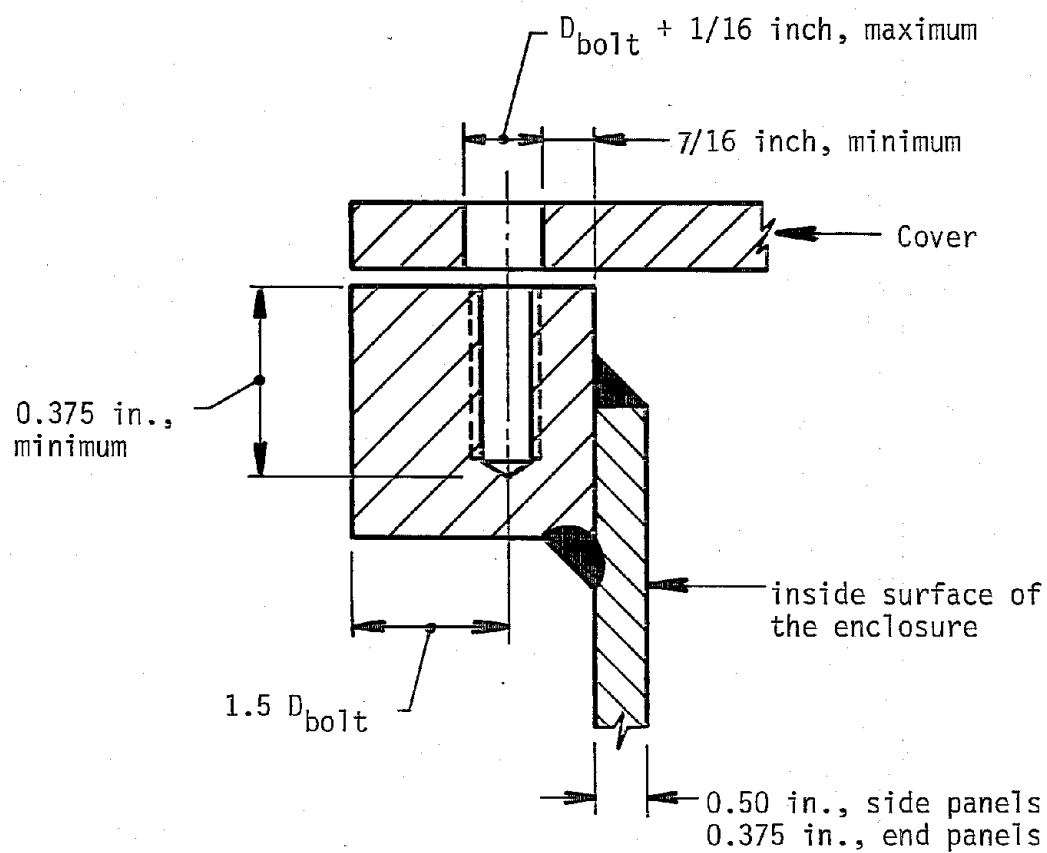


Figure 14.2. Geometry of the Flange and Cover at the Bolt Holes

inch bolts are assumed, the cover dimensions are (from Figures 14.1 and 14.2):

$$\begin{aligned} a &= 18 + 2[0.5 + 7/16 + \frac{0.75 + .0625}{2} + 1.5(0.75)] \\ &= 22.94 \text{ in.} \end{aligned}$$

$$\begin{aligned} b &= 36 + 2[0.375 + 7/16 + \frac{0.75 + .0625}{2} + 1.5(.75)] \\ &= 40.7 \text{ in.} \end{aligned}$$

$$\text{Area} = 22.9 \times 40.7 = 932 \text{ in}^2$$

$$b/a = 40.7/22.9 = 1.78 \approx 1.8$$

As noted previously, the cover and bolt strengths are

$$\begin{aligned} \text{cover: } \sigma_y &= 40,000 \text{ psi} \\ \text{bolts: } \sigma_y &= 85,000 \text{ psi} \\ \sigma_u &= 120,000 \text{ psi} \end{aligned}$$

From Appendix B, the most appropriate combination of bolts and cover thickness, for $A = 950 \text{ in}^2$ and $b/a = 1.8$, is

$$\text{cover thickness} = 0.875 \text{ in.}$$

$$\text{bolt diameter} = 0.75 \text{ in.}$$

$$N_a = 5$$

$$N_b = 10$$

This combination of cover thickness and bolt diameter gives a maximum bolt stress of 126 ksi, which exceeds σ_u of the bolt by a small margin. Because the enclosure cover is smaller than the 950 in^2 value used to enter the table, the combination chosen should be adequate. Note that bolt axial stresses are much less than the bolt yield

stress. The total number of bolts in the cover will be twenty-six (26) because the four corner bolts are common to both sides.

Thread Engagement--The length of thread engagement required to fully develop the bolt is given by Equations 11.3 - 11.5, when the tapped material, the flange, is weaker than the bolt.

$$L_e = \frac{2A_t}{\pi K_{N\max} \left[\frac{1}{2} + .57735n (E_{S\min} - K_{N\max}) \right]} \dots \text{Equation 11.3}$$

From Reference 15 we find, for the 3/4 inch bolts,

$$n = 10$$

$$A_t = 0.334$$

$$K_{N\max} = 0.663$$

$$E_{S\min} = 0.6744$$

$$L_e = \frac{2(.334)}{\pi(.663) \left[\frac{1}{2} + .57735(10) (.6744 - .663) \right]}$$

$$L_e = 0.567 \text{ in.}$$

$$A_S = \pi n L_e K_{N\max} \left[\frac{1}{2n} + 0.57735 (E_{S\min} - K_{N\max}) \right] \dots \text{Equation 11.5}$$

$$A_S = \pi(10)(.52)(.663) \left[\frac{1}{2(10)} + .57735(.6774 - .663) \right]$$

$$= .6316$$

$$A_N = \pi N L_e D_{S\min} \left[\frac{1}{2n} + .57735(D_{S\min} - E_{N\max}) \right] \dots \text{Equation 11.5}$$

$$D_{S\min} = 0.7288 \dots \text{from Reference 15}$$

$$E_{N\max} = 0.6965 \dots \text{from Reference 15}$$

$$A_N = \pi (10)(0.52)(.7788) \left[\frac{1}{2(10)} + .57735(.7288 - .6965) \right]$$

$$= 0.817$$

$$J = \frac{A_S \times \text{Bolt } \sigma_u}{A_N \times \text{flange } \sigma_u} \dots \text{Equation 11.5}$$

$$= \frac{0.6316(120,000)}{0.817(55,000)} = 1.686$$

$$L_e' = J \times L_e \dots \text{Equation 11.4}$$

$$L_e' = 1.686(.52) = 0.877 \text{ in.}$$

This is easily met by a 1-inch deep flange (see Figure 14.2), which will clearly exceed the minimum requirements for flange thickness and engagement as specified by MSHA and also exceeds one bolt diameter.

Window Design (Ch. 8)--The window geometry will be circular and mounted according to Figure 8.11(b), except that the retainer will be on the inside of the enclosure. No gaskets will be used with the LEXAN window. Figure 8.2 is used to determine the window thickness, for a design stress of $1/2 (\sigma_y)$ as specified in Section 13.3.

Thickness:

$$\sigma_m = K_1 (D_i/t)^2 P \dots \text{from Figure 8.2}$$

$$\sigma_m = 1/2 (\sigma_y) = 1/2 (9,000) = 4500 \text{ psi} \dots \text{from Table 13.3}$$

$$K_1 = 0.1875 \dots \text{for clamped edges, Figure 8.2}$$

$$D_i = 4.5 \text{ in} \dots \text{from Figure 14.1}$$

$$P = \text{static design pressure} = 150 \text{ psig}$$

$$t = \left[\frac{(.1875)(4.5)^2(150)}{4500} \right]^{1/2} = .355 \text{ in}$$

Choose a 3/8-inch thick window pane.

Mounting: Details of the mounting arrangement are given in Figure 14.3. The flange thickness is determined by Figure 8.23. For strength,

$$t_f \geq \left[\frac{2 V_{MAX} (2\ell - c)}{\sigma_y} \right]^{1/2} \geq 3/16 \text{ in.}$$

$V_{MAX} = 0.25 pD = 0.25(150)(4.5 + 2 \times .5) = 206 \text{ lb/in}$ (Note that the overall window diameter is used for this calculation.)

$\ell = 0.625 \text{ in.}$ from Figure 14.3

$c = 0.5 \text{ in.}$ minimum value from Figure 8.8

$\sigma_y = 40,000 \text{ psi.}$ from Table 13.2 (6061-T6)

$$t \geq \left[\frac{2(206)(2 \times .625 - .5)}{40,000} \right]^{1/2} = 0.088 \text{ in.}$$

For stiffness:

$$t_f \geq \left[\frac{540(206)(2 \times .625 - .5)^2}{\pi(29 \times 10^6)} \right]^{1/3} = 0.088 \text{ in.}$$

Choose $t_f = 3/16 \text{ in.}$, the minimum allowable value.

Because operating temperatures are near ambient, there is no need to check the window for thermally induced stresses.

The window retainer is of cast aluminum and will be made to the same nominal dimension as the flange, or 3/16 inch. To secure the window against external impact loads, the bolts securing the ring will be sized to withstand V_{MAX} . For four bolts the load per bolt is:

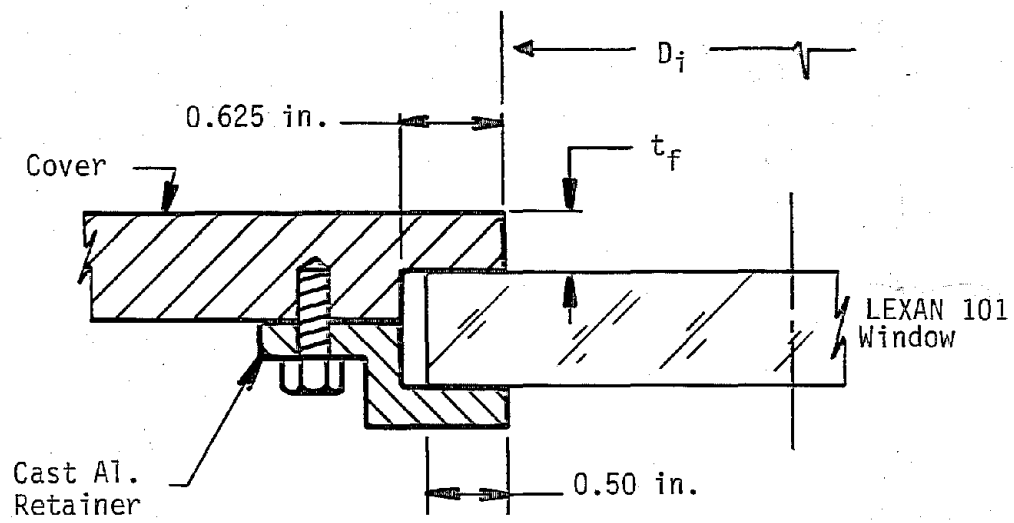


Figure 14.3 Window Mounting Details

$$\frac{1}{4} (\pi D V_{MAX}) = \frac{1}{4} (\pi)(5.5)(206)$$

$$= 890 \text{ lb}$$

Bolts will be 1/4-inch Grade 5, with UNC Class I threads, which have a proof load of:

$$P_b = A_s \sigma_y = 2694 \text{ lb}$$

The allowable bolt load is approximately three times the applied load, which is more than adequate.

Window Guard: MSHA requires that windows with an exposed area greater than 8 in² be protected by location or with a window guard (Ch. 3), and Section 8.10.18 gives a design procedure for open-mesh window guards which are fully restrained at their boundary so that membrane forces are developed. The effective thickness of the open mesh guard is given by:

$$h = \left[\frac{W_o^2}{16} + \frac{1}{6} \frac{qR^2}{\sigma_y} \right]^{1/2} - \frac{1}{4} W_o \dots \text{from Figure 8.27}$$

$W_o = 0.25 \text{ in.}$ this value is less than 0.2R and is slightly greater than t_f ; thus the guard must be raised above the cover to avoid window contact (see window reinforcement)

$q = 300 \text{ psi.}$ twice the design loading for the cover

$R = 2.75 \text{ in.}$ assume that the guard extends 0.50 inches beyond the windows edge

$\sigma_y = 40,000 \text{ psi.}$ assumed yield strength for the mesh

$$h = \left[\frac{(.25)^2}{16} + \frac{1}{6} \frac{(300)(2.75)^2}{40,000} \right]^{\frac{1}{2}} - \frac{1}{4} (.25)$$

$$= 0.053 \text{ in.}$$

Thus, a mesh must be selected with openings of less than or equal to 1-inch clearance and an equivalent thickness equal to or greater than 0.053 inches.

Reinforcement of the Window Opening (Ch. 12)--The window retaining ring on the inside of the cover will contribute to the reinforcement of the opening. In utilizing the contribution of the ring, we will take a conservative approach and design according to Equations 12.2 and 12.3 which are based upon maintaining equivalent tensile strength at the opening, and equal yield strengths for the plate and reinforcement.

$$h_r = \frac{ch}{2W_r} \dots \dots \text{Equation 12.2}$$

$$W_r = 1 \text{ in.} \dots \dots \text{choose as a starting value}$$

$$\sigma_{YR} = \sigma_{YP} = 40,000 \text{ psi.} \dots \dots \text{Table 12.2 for 6061-T6 Aluminum}$$

In this case the area removed, $c \times h$, may be reduced by the area of the window retaining ring. The ring area is (Figure 14.3).

$$A_{\text{ring}} \approx 3/16 \text{ in.} \times 1.625 \times 2 = 0.61 \text{ in}^2$$

If the yield strength of the retaining ring is different from that of the plate, then the area must be adjusted. Assume that the retaining ring is A201.0 T4 cast aluminum. From Table 12.2 its yield strength is $\sigma_y = 31,000$ psi. The cover is 6061-T6, so an adjustment is necessary; the adjusted area is:

$$A'_{\text{ring}} = 0.61 \times \frac{31,000}{40,000} = 0.47 \text{ in}^2$$

Now an effective area removed, $(ch)'$, is:

$$\begin{aligned}(ch)' &= ch - A'_{\text{ring}} \\&= 4.5 \text{ in.} \times 0.875 \text{ in.} - 0.47 \text{ in.}^2 \\&= 3.67 \text{ in.}^2\end{aligned}$$

Substituting into Equation 12.2 we find

$$h_r = \frac{3.67}{2(1 \text{ in.})} = 1.73 \text{ in.}$$

or, if $W_r = 2 \text{ in.}$

$$h_r = \frac{3.67}{2(2)} = 0.9175$$

Because a conservative approach was used (based on tensile strength rather than the bending strength) choose 3/4-inch plate for the reinforcing ring which will have an outside diameter of 8.5 inch and an inside diameter of 4.5 inch.

Ruggedness (Ch. 7)--The cover and one long side of the enclosure are exposed to impact in the mine environment. Equation 7.1 is used to check the adequacy of the enclosure for the impact loads.

Cover: The cover is exposed to roof fall and must be checked for a kinetic energy of (Table 7.1)

$$KE = 3700 \text{ ft-lb/ft}^2$$

The unsupported cover area is (see Figures 14.1 and 14.2):

$$\begin{aligned}A &= (18 + 2 \times 0.5)(36 + 2 \times 0.375) \\&= 19 \times 36.75 = 698 \text{ in.}^2 = 4.95 \text{ ft}^2\end{aligned}$$

This gives a total KE for the cover of

$$KE = 3700 \text{ ft-lb} \times 4.85 \text{ ft}^2 \times 12 \text{ in/ft}^2 = 215 \times 10^3 \text{ in-lb}$$

Table 5.1 gives R_m of the cover as

$$R_m = 12 M_p^o [STRF_a + E_j^a + c (STRF_b + E_j^b)]$$

For the fully reinforced window opening $STRF_a = STRF_b = 1.0$.

Efficiencies of the bolted joint are given by Equations 11.1 and 11.2 (also see Figure 11.1).

$$E_j^a = \frac{8F_Y e_a N_a}{3 a h^2 \sigma_y}$$

From the cover design in this example we find:

$$F_Y = A_t \sigma_y = 0.334 (85,000) = 28390 \text{ lb}$$

$$e_a = 1.5 (.75) = 1.125 \text{ in.....see Figure 14.2}$$

$$N_a = 5 \dots \text{number of bolts on side a}$$

$$a = 19 \text{ in.}$$

$$\sigma_y = 40,000 \text{ psi....cover yield stress}$$

$$h = 0.875 \text{ in....cover thickness}$$

Now:

$$E_j^a = \frac{8(28390)(1.125)(5)}{3(19)(.875)^2(40,000)} = 0.73$$

Likewise,

$$E_j^b = \frac{8(28390)(1.125)(10)}{3(36.75)(.875)^2(40,000)} = 0.76$$

$$a/b = 19/36.75 = 0.52$$

$$c \approx 1.5 \dots \text{from Figure 5.1}$$

$$M_p^o = \frac{1}{4} \sigma_y h^2 = (.25)(40,000)(.875)^2 \dots \text{Table 5.1}$$

$$= 7656$$

Now

$$R_m = 12(7656) [1 + .73 + 1.5(1 + .76)]$$

$$= 401 \times 10^3 \text{ lb}$$

Substituting into Equation 7.1

$$215 \times 10^3 \leq 401 \times 10^3 (0.875) = 351 \times 10^3$$

The inequality holds so the cover satisfies the ruggedness criteria.

Sides: The enclosure side is exposed to a kinetic energy of (Table 7.1)

$$KE = 8000 \text{ ft-lb} = 96 \times 10^3 \text{ in lb}$$

Using the data from the initial sizing of the sides for dynamic loads we have:

$$h = 0.50 \text{ in.}$$

$$a/b = 12/36 = 0.33$$

$$STRF_a = STRF_b = 1.0$$

$$E_j^a = 0.40$$

$$E_j^b = 1.0$$

$$M_p^o = 1/4 (36,000)(0.50)^2 = 2250 \text{ in-lb/in.}$$

$$R_m = 12(2250)[1.0 + 0.2 + 1.50(1.0 + 1.0)]$$

$$= 113,400 \text{ lb}$$

Substituting into Equation 7.1

$$KE = 96,000 \text{ in lb} \leq R_m h = 113,400(.5) = 56,700 \text{ in-lb}$$

The condition is not satisfied and the sides of the enclosure must be increased to satisfy the ruggedness requirement.

Try a 5/8-inch plate for the enclosure sides. Only M_p^o and thus R_m will change:

$$M_p^o = 1/4 (36,000)(.625)^2 = 3516 \text{ in-lb/in}$$

$$R_m = 12(3516)[1.0 + 0.2 + 1.5(1.0 + 1.0)]$$

$$= 177,188 \text{ lb}$$

$$R_m h = 177,188 (.625) = 110,742 \text{ in-lb} > 96,000 \text{ in-lb}$$

The ruggedness criterion is now satisfied for the side of the enclosure.

Buckling of side and end panels (Sect. 7.2.1): The highest load will be applied to the top of the enclosure by the rock fall. A potential, but unlikely, failure mode is buckling of the side and end panels which support the cover. Panel buckling loads are predicted by Equation 7.4.

$$\bar{P} = \sigma_y b_e h \text{ Equation 7.4}$$

$$b_e = b \left[\frac{\sigma_{cr}}{\sigma_y} \right]^{1/3} \text{ Equation 7.5}$$

$$\sigma_{cr} = \frac{\lambda_{cr}^2 \pi^2 E}{12(1 - \nu^2)} \left(\frac{h}{b} \right)^2 \text{ Equation 7.8}$$

$$\lambda_{cr} = \text{minimum of } \left(m + \frac{1}{m} \frac{a^2}{b^2} \right)^2$$

$$a/b = 12/36 = 0.333$$

$$m = 1: \lambda_{cr} = \left[1 + \frac{1}{1} (.333)^2 \right]^2 = 1.234$$

$$m = 2: \left[2 + \frac{1}{2} (.333)^2 \right]^2 = 4.225$$

Therefore, $\lambda_{cr} = 1.234$. Using properties for the steel plate defined previously, the critical buckling stress is

$$\begin{aligned} \sigma_{CR} &= \frac{1.234^2 \pi^2 (29 \times 10^6)}{12(1 - .3^2)} \left(\frac{.625}{12} \right)^2 \\ &= 87,738 \text{ psi} > \sigma_y \end{aligned}$$

Therefore, the plate will not buckle and

$$b_e = b$$

which gives

$$\begin{aligned} \bar{P} &= \sigma_y b h = (36,000)(36)(.625) \\ &= 810,000 \text{ lb} \end{aligned}$$

This value of $\bar{P}$ alone exceeds R_m for the cover (which is 377,000 lb) so the criterion of Equation 7.9, i.e.,

$$\sum_{i=1}^4 \bar{P}_i > R_m$$

is satisfied.

14.1.2 Summary of the Design Calculations

The final specifications for the rectangular enclosure are:

Internal dimensions: 36 in. x 18 in. x 12 in. (Figure 14.1)

Sides and bottom: continuous 5/8-inch AISC 1025 rolled steel plate

Ends: 3/8-inch AISC 1025 steel plate welded to sides, bottom and flange with Class IV welds

Cover: 40.7 in. x 22.9 in. x 7/8 in. 6061-T6 aluminum plate

Bolts: Grade 5 3/4-inch bolts with UNC Class I threads. Nine (10) bolts per long side and five (5) bolts per short side

Flange: AISC 1025 steel bar with cross section of 1 in. depth x 1.75 in. wide (see Figure 14.2), welded to sides and ends with Class IV welds

Window: 3/8-inch LEXAN 101 mounted without gaskets (Figure 14.3)

Window retainer: 3/16-inch thick cast aluminum, A201.0 T4, secured by four Grade 5 1/4-inch bolts with UNC Class I threads (Figure 14.3)

Window guard: Flat open mesh guard of 6061-T6 A2 (or equivalent) with an equivalent thickness of 0.053 inches. The guard is 5.5 inches in diameter and is welded firmly to the cover.

Cover reinforcing at the window: Ring of 6061-T6 Al (or equivalent) which is 7/8-inch thick with OD = 8.5 inches and an ID which matches the window opening.

14.2 Cylindrical Enclosure

14.2.1 Design Calculations

Geometry - Internal dimensions of the enclosure are shown in Figure 14.4. Detailed dimensions will be established in the design calculations.

Internal Arrangement - One large cylindrical component occupies about 50 percent of the internal volume. It attaches to the end of the enclosure, opposite the door, and extends to within 2 inches of the cover end. The component is centered in the volume so that no compartmentation occurs, but the remaining volume is annular with a 2-inch disk-shaped space on the cover end.

Materials - The cylindrical part of the enclosure is made from steel pipe with properties equivalent to SA-573 Grade 65 steel. SA-573 Grade 65 steel plate will be used to fabricate the cover and the opposite end. Properties for this material are given in Chapter 13.

Bolts - Grade 5 bolts with Class I UNC threads will be used to attach the cover to the enclosure. Bolt allowable stresses are

$$\sigma_y = 85,000 \text{ psi}$$

$$\sigma_u = 120,000 \text{ psi}$$

MSHA Requirements (Ch. 3) - The enclosure falls into the large volume category. Dimensional constraints on the cylindrical enclosure are the same as for the rectangular enclosure given in the previous example.

Design Pressures (Ch. 4) - The design static pressure for the enclosure is 150 psig. Pressure piling is not expected in the enclosure so the dynamic design

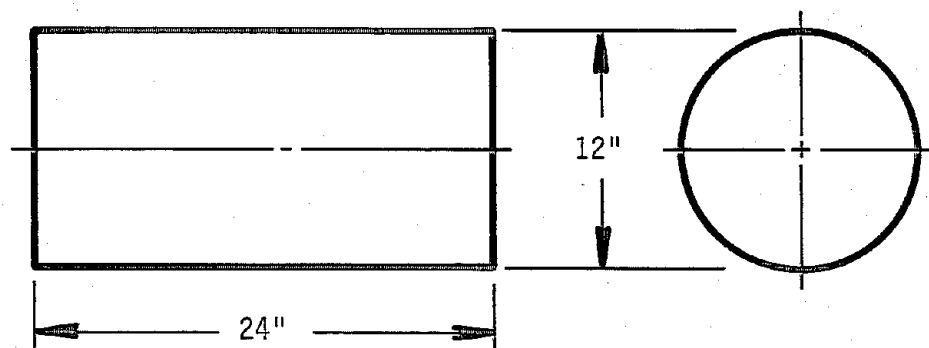


Figure 14.4. Internal Dimensions of the Cylindrical Enclosure

pressure is 100 psig. Pressure piling is not expected because the interior of the enclosure is not compartmented and the exterior surface of the internal equipment is reasonably smooth. The estimated minimum rise time for the dynamic (explosion) pressure is

$$t_{r_{\min}} = 21[V]^{1/3} \dots \text{Equation 4.5}$$

$$V = \frac{\pi}{4} (1 \text{ ft.})^2 \times 2 \text{ ft.} \dots \text{Figure 14.4}$$

$$= 1.57 \text{ ft}^2$$

$$t_{r_{\min}} = 21[1.57]^{1/3} = 24.4 \text{ msec}$$

Weld Joint Design (Ch. 10) - Class IV welds will be used to joint the flange and circular end to the cylindrical pipe section. The pipe section will be seamless or butt-welded as received.

Design of Cylinder and End Panel - Thickness of the cylinder and end panel will first be determined for the static design pressure of 150 psig and then checked for the dynamic design pressure of 100 psig.

Static Pressure (Ch. 5)

Cylinder (Section 5.3):

$$h = \frac{1.05 \text{ pR}}{\sigma_y} \dots \text{Equation 5.6}$$

$$R = 6 \text{ in.} \dots \text{Figure 14.4}$$

$$\sigma_y \approx 30,000 \text{ psi} \dots \text{For standard steel pipe}$$

$$h = \frac{1.05(150 \text{ psi})(6 \text{ in})}{30,000 \text{ psi}} \dots\dots 0.0315 \text{ in.}$$

Schedule 20 pipe has a wall thickness of 0.250 inch and will be used for the cylinder. The pipe has an outside diameter of 12.75 inch and an inside diameter of 12.25 inch.

End Plate (Section 5.2):

$$h = \left[\frac{pR^2}{1.5 \sigma_y (1 + E_j^a)} \right]^{1/2} \dots\dots \text{Equation 5.4}$$

$$R = 6.125 \text{ in.}$$

$$\sigma_y = 35,000 \text{ psi} \dots\dots \text{Table 13.1 for SA-573 Grade 65 Steel}$$

$$E_j^a = .80 \dots\dots \text{for Class IV weld}$$

$$h = \left[\frac{(150 \text{ psi})(6.125)^2}{1.5(35,000)(1 + .8)} \right]^{1/2} = 0.24 \text{ in.}$$

Choose 1/4-inch plate.

Dynamic Pressure (Ch. 6) - An equivalent static pressure is determined by Equation 6.3 and the procedures of Chapter 5 are again used to compute thickness.

Cylinder:

$$\omega = \frac{1}{R} \left[\frac{E}{\rho(1-\nu^2)} \right]^{1/2} \dots\dots \text{Table 6.2}$$

$$R = 6.125 \text{ inch} \dots\dots \text{from static pressure analysis}$$

$$E = 29 \times 10^6 \text{ psi} \dots\dots \text{from Table 13.1 for SA-573 Grade 65 Steel}$$

$$v = 0.30 \dots \text{from Table 13.1}$$

$$\rho = 0.286 \text{ lb/in}^3 \dots \text{density in force units from Table 13.1}$$

$$\rho = \frac{.286}{386} \frac{\text{lb/sec}^2}{\text{in}^4} \dots \text{density in appropriate mass units}$$

$$\omega = \frac{1}{6.125 \text{ in.}} \left[\frac{29 \times 10^6 \text{ lb/in}^2}{\left(\frac{.286}{386} \frac{\text{lb/sec}^2}{\text{in}^4} \right) (1 - .3^2)} \right]^{1/2}$$

$$= 33,860 \text{ 1/sec}$$

$$T = \frac{2\pi}{\omega} = 0.186 \text{ msec} \dots \text{fundamental breathing period of the cylinder}$$

$$\frac{t_{r \min}}{T} = \frac{24.4 \text{ msec}}{.186 \text{ msec}} = 131 \dots \text{to enter Figure 6.1 or Equation 6.1}$$

$$\text{DLF} \approx 1.0 \dots \text{from Equation 6.1}$$

The equivalent static pressure is now computed as

$$P_{eq} = P \times (\text{DLF})_{\text{MAX}} \times 1.62 \dots \text{Equation 6.3}$$

$$= 100 \text{ psi} \times 1.0 \times 1.62$$

$$= 162 \text{ psi}$$

$$h = \frac{1.05 \text{ pR}}{\sigma_y} \dots \text{Equation 5.6}$$

$$= \frac{1.05(162 \text{ psi})(6.125 \text{ in.})}{30,000 \text{ psi}} = 0.035 \text{ in.} \ll 0.25 \text{ in.}$$

The Schedule 20 pipe is adequate for the dynamic loads also.

End Plate: The end plate is not fully clamped nor simply supported; therefore, we will estimate the frequency by averaging the two conditions.

$$\omega = \frac{1/2(10.22 + 4.98)}{R^2} \left[\frac{D}{\rho h} \right]^{1/2} \dots \text{Table 6.2}$$

$$D = \frac{Eh^3}{12(1 - \nu^2)} \dots \text{Table 6.2}$$

$h = 0.25$ in.....from static calculations

E , ρ and ν were defined for the static calculations

$$D = \frac{(29 \times 10^6 \text{ psi})(0.25)^3}{12(1 - .3^2)} = 41,495 \text{ in/lb}$$

Now:

$$\begin{aligned} \omega &= \frac{1/2(10.22 + 4.98)}{(6.125)^2} \left(\frac{41,495}{(.286/386)(.25)} \right)^{1/2} \\ &= 3032 \text{ 1/sec} \end{aligned}$$

$$T = \frac{2\pi}{\omega} = 2.07 \text{ msec}$$

$$\frac{t_r}{T} = \frac{24.4}{2.07} = 11.8 \dots \text{to enter Figure 6.1 or Equation 6.1}$$

For values of t_r/T well beyond 4.0 use Equation 6.1.

$$(DLF)_{MAX} = 1 + \frac{1}{2\pi(11.8)} = 1.014$$

Now

$$P_{Eq} = p \times (DLF)_{MAX} \times 1.62 \dots \text{Equation 6.3}$$

$$= 100 \text{ psi} \times 1.014 \times 1.62$$

$$= 164 \text{ psi}$$

$$h = \left[\frac{pR^2}{1.5 \sigma_y (1 + E_j^b)} \right]^{1/2} \dots \text{Equation 5.4}$$

$$\sigma_y = 35,000 \text{ psi} \dots \text{from Table 13.1}$$

$$E_j^b = 0.4 \dots \text{dynamic loading, Class IV weld} \dots \text{Figure 10.1}$$

Now

$$h = \left[\frac{(164 \text{ psi})(6.125 \text{ in})^2}{1.5(35,000 \text{ psi})(1 + 0.4)} \right]^{1/2} = 0.29 \text{ in.}$$

Choose 3/8-inch plate. To be certain that the plate is adequate, the calculation should be repeated.

Penetration (Ch. 7) - Two penetrations for electrical loads are placed through the cylinder. The inside diameter of the penetration is 2 inches.

Reinforcement for penetration through the cylinder is based on Equations 12.2 through 12.5. For equal strength material Equation 12.2 will be used.

$$h_R = \frac{ch}{2W_R} \dots \text{Equation 12.2}$$

Choose $W_R = 0.75 \text{ in.}$ for a reinforcement ring that is flush with the inside of the cylinder (see Figure 12.1).

$$c = 2.0 + 2 \times 0.75 = 3.5 \text{ in.} \dots \text{hole dimension plus reinforcement}$$

$$h = 0.25 \text{ in.} \dots \text{cylinder thickness}$$

$$h_R = \frac{(3.5 \text{ in.})(.25 \text{ in.})}{2(.75 \text{ in.})} = 0.60 \text{ inch}$$

The reinforcement ring will set flush with the inside of the cylinder and extend about 0.35 inches from the outside dimension--two places.

Bolted Cover (Ch.11) - Solutions for bolted covers given in Chapter 11 are for rectangular geometries. A reasonable choice for a circular cover can be made by choosing a square cover of the same area. For an outside flange, the geometry of the flange will be the same as shown in Figure 14.2. Only the wall thickness will be different; in this case it will be 0.25 inch. If 3/8-inch bolts are assumed the cover diameter will be

$$D = 12 + 2 \times [.25 + 7/16 + \frac{.375 + .0625}{2} + 1.5(.375)]$$

$$= 14.94 \text{ in.}$$

$$= 15.0 \text{ in}$$

$$A = \frac{\pi}{4} D^2 = 177 \text{ in}^2$$

Appendix A gives peak cover and bolt stresses for different combinations of bolts, steel cover areas and aspect ratios. The cover area falls in between the values of 150 in² and 200 in². For a 150 in² square cover the choice for Grade 5 bolts would be

cover thickness: $h = 0.50 \text{ in.}$ (0.375 in. is adequate, but 0.50 in. is the minimum allowed by MSHA)

Bolt diameter: 1/2 inch

No. of bolts: 8 (3 per side for a square plate)

For 200 in² the choice is

cover thickness: $h = 0.50$

Bolt diameter: 1/2 inch

No. of bolts: 12 (4 per side for a square plate)

Because bolt stresses are low for these two conditions ($\sigma_{MAX} = 76.4 \text{ ksi}$), 10 bolts will be satisfactory for a 177 in² cover area.

Ruggedness (Ch. 7) - The cylinder lays horizontally on the miner with the cover exposed to side impacts and the cylinder to roof falls.

Cover (Section 7.1): Side impact subjects the cover to a kinetic energy of (Table 7.1)

$$KE = 800 \text{ ft/lb} = 96,000 \text{ in/lb}$$

Equation 7.1 is used to check the adequacy of the cover.

$$KE \leq R_m \times h \dots \text{Equation 7.1}$$

$$R_m = 18.8 M_p^O (1 + E_j^b) \dots \text{Equation 5.3}$$

$$M_p^O = \frac{1}{4} \sigma_y h^2 \dots \text{Equation 5.3}$$

$$= \frac{1}{4} (35,000 \text{ psi})(0.50 \text{ in})^2$$

$$= 2188 \text{ in.-lb/in.}$$

The joint efficiency of the bolted cover is given in Chapter 11.

$$E_j^a = \frac{8 F_y e_a N_a}{3a h^2 \sigma_y} \dots \text{Equation 11.1}$$

For this case

$$a = 2\pi R \dots R = \text{radius at the bolt circle}$$

$$= 2\pi[6 + .25 + 7/16 + \frac{.5 + 0.625}{2}]$$

$$= 2\pi(6.97) = 43.8 \text{ in.}$$

$$F_y = A_t \sigma_y$$

$$A_t = 0.1419 \text{ in.}^2 \dots \text{from Reference 15}$$

$$\sigma_y = 85,000 \text{ psi....for Grade 5 bolts}$$

$$e_a = 1.5(.5) = 0.75 \text{ in.}$$

$$N_a = 10....\text{total no. of bolts}$$

Now

$$E_j^a = \frac{8(.1419 \text{ in}^2)(85,000 \text{ psi})(.75)(10)}{3(43.8 \text{ in.})(0.50 \text{ in.})^2(35,000 \text{ psi})}$$

$$= 0.63$$

$$R_m = 18.8(2188 \text{ in. lb/in.}) (1 + 0.63)$$

$$= 67,049 \text{ lb}$$

Obviously $R_m < KE$, so that Equation 7.1 is not satisfied. To meet the ruggedness criteria, solve for the required thickness using the equation for a circular plate from Table 7.2.

$$h = \left[\frac{KE}{4.7 \sigma_y (1 + E_j^a)} \right]^{1/3}$$

$$= \left[\frac{(96,000 \text{ in/lb})}{4.7 (35,000 \text{ psi})(1 + .63)} \right]^{1/3}$$

$$= 0.71$$

Choose 3/4-inch plate or a higher strength steel. It should be noted that the ruggedness requirement, proposed in Reference 2 for lateral impact, is very severe for small covers, and perhaps it should be revised to make it area-dependent as was done for roof fall exposure. Note that the efficiency of the bolted joint is reduced when the cover thickness is increased, and the above calculation should be redone with the corrected E_j^a .

Cylinder with Transverse Loading (Sect. 7.3): The side of the enclosure is exposed to a roof fall and must resist a kinetic energy of

$$\begin{aligned} KE &= 3700 \text{ ft-lb/ft}^2 \times 2 \text{ ft} \times 1 \text{ ft} \dots \text{Table 7.2} \\ &= 7400 \text{ ft-lb} \\ &= 88,800 \text{ in-lb} \end{aligned}$$

Ruggedness is checked using the graphical solutions in Figure 7.2. In keeping with the recommendations of Chapter 7, we want the deformation of the cylinder to be less than the wall thickness or 0.25 inches. This gives

$$\Delta R_o / R = \frac{0.25}{6} = 0.042$$

as our goal. To enter the figure we must first calculate the non-dimensional quantities:

$$KE/M_p^o L, R/L \text{ and } R^3/L^2 h$$

where

$$\begin{aligned} KE &= 88,800 \text{ in-lb} \dots \text{determined above} \\ M_p^o &= 1/4 \sigma_y h^2 \dots \text{from Table 5.1} \\ R &= 6.25 \text{ in} \dots \text{for the Sch 20 pipe} \\ h &= 0.25 \text{ in} \dots \text{for the Sch 20 pipe} \\ L &= 24 \dots \text{given for this example} \\ \sigma_y &= 30,000 \text{ psi} \dots \text{for standard pipe} \end{aligned}$$

Now

$$\begin{aligned} M_p^o &= 1/4(30,000 \text{ psi})(.25)^2 = 469 \text{ in-lb/in} \\ KE/M_p^o L &= 88,800 \text{ in-lb}/(469 \text{ in-lb/in})(24 \text{ in.}) = 7.89 \\ R/L &= 6/24 = 0.25 \\ R^3/L^2 h &= (6)^3/(24)^2(.25) = 1.5 \end{aligned}$$

From Figure 7.2(a) it is apparent that the deformation will exceed 0.6R if only bending is considered. Clearly some membrane action should occur. Entering Figure 7.2(b) we find that deformations exceed 0.25R.

If the thickness of the cylinder is doubled, i.e., $h = 2 \times .25 = 0.5$ in., then

$$\frac{KE}{M_p \sigma_L} = \frac{1}{(2)^2} (7.89) = 1.97 \dots \text{by scaling the previous value}$$

$$R^3/L^2h = \frac{1}{2}(1.5) = 0.75$$

As Figure 7.2(b) shows, the deformations are now approximately equal to $0.25R$ (by choosing a value just below the line for $R^3/L^2h = 1$).

This example illustrates that it is very difficult to limit deformations in externally loaded cylinders to the wall thickness.

This ruggedness calculation will not be carried further. It is suggested that cylindrical surfaces of XP-enclosures not to be exposed to direct roof falls. The remainder of this example is based on the wall thickness of 0.25 inches determined in the static pressure calculations.

Cylinder-Longitudinal Buckling (Sect. 7.2.2): Depending upon how the enclosure is mounted, the loading on the cover may be transferred through the cylinder as an axial load. Equations 7.10 and 7.11 are used to check the adequacy of the cylinder.

$$\bar{P} \geq R_m \text{ of the cover} \dots \text{Equation 7.9}$$

where

$$\bar{P} = \sigma_{CR} \pi (R_o^2 - R_i^2) \dots \text{Equation 7.10}$$

$$\sigma_{CR} = \frac{.3Eh}{R} \dots \text{Equation 7.11}$$

$$\text{for } \lambda > 5.16 \sqrt{Rh}$$

$$5.16 \quad Rh = 5.16 (6.125)(.25) = 6.4$$

$$\lambda = 24 > 6.4$$

So

$$\begin{aligned}\sigma_{CR} &= \frac{(.3)(29 \times 10^6)(.25)}{6.125} \\ &= 355,000 \text{ psi} \gg \sigma_y\end{aligned}$$

Therefore,

$$\sigma_{CR} = \sigma_y = 35,000 \text{ psi in Equation 7.10}$$

Now

$$\begin{aligned}\bar{P} &= (35,000 \text{ psi})\pi \left[\left(\frac{12.75}{2} \right)^2 - \left(\frac{12.25}{2} \right)^2 \right] \\ &= 343,600 \text{ lb}\end{aligned}$$

Recalculate R_m of the cover for $h = 0.75$ in. (refer to Bolted Cover in this example):

$$\begin{aligned}E_J^a &= \frac{(8)(.1419)(85,000)(.75)(10)}{3(43.8)(.75)^2(35000)} \\ &= 0.28\end{aligned}$$

$$\begin{aligned}R_m &= 18.8\left(\frac{1}{4}\right)(35,000)(.75)^2(1 + .28) \dots \text{Equation 5.3} \\ &= 118,440 \text{ lb}\end{aligned}$$

$$\bar{P} \geq R_m$$

So the ruggedness criterion is satisfied.

14.2.2 Summary of the Design Calculations

The final specifications for the cylindrical enclosure are:

Internal dimensions: 24 in. long x 12 in. dia. (Fig. 14.4)

Cylinder: 12 inch Sch 20 seamless or butt welded pipe

Closed end: 0.375 inch SA-573 Grade 65 steel plate joined to cylinder with Class IV weld

Cover: 15-inch diameter and 0.75 inch thick circular plate of SA-573 Grade 65 steel.

Bolts: Ten (10) Grade 5 0.5-inch diameter bolts with Class I UNC threads

Penetrations: Two, 2-inch diameter penetrations are reinforced with a through-the-wall boss which is flush with the inside of the wall, has an outside diameter of 3.5 inches, and a length of 0.60 inch.

Note: The ruggedness criteria of this guide is not met by the cylinder for lateral impact by a roof fall.

14.3 Irregular Cover

14.3.1 Design Calculations

Geometry - Overall dimensions of the irregular cover are given in Figure 14.5. The thickness and bolt locations will be determined in the design calculations.

Materials - The cover will be made of 6061-T6 aluminum plate, including the reinforcement around the window. The window will be of borosilicate glass. Material properties for these approved materials are given in Chapter 13.

Bolts - Grade 5 bolts with Class I UNC threads will be used to attach the cover to the enclosure. Bolt allowable stresses are:

$$\sigma_y = 85,000 \text{ psi}$$

$$\sigma_u = 120,000 \text{ psi}$$

MSHA Requirements (Ch. 3) - MSHA requirements that affect the cover design (selection of cover thickness and bolt size) are:

Minimum cover thickness	0.50 in.
Maximum joint clearance	0.004 in.
Maximum bolt spacing	6.00 in.
Minimum bolt diameter	0.375 in.

Design Pressures (Ch.4) - For this problem, we assume no pressure piling and take the volume as 5 ft^3 for purposes of computing the rise time. Design values are:

$$\begin{aligned}\text{Static: } P &= 150 \text{ psi} \\ \text{Explosion: } P_{\text{EXP}} &= 100 \text{ psia} \\ t_{r_{\min}} &= 21 [5]^{1/3} = 36 \text{ msec.}\end{aligned}$$

Bolted Cover (Ch. 11) - Cover design must be based upon the data of Appendix B which were developed for rectangular covers. To do this, the irregular cover of Figure 14.5 will be treated as two covers, one 18 in. x 36 in. and one 16 in. x 30 in. The maximum cover thickness and bolt size, determined for either cover segment, will be chosen as the design values, with some consideration for bolt spacing and the interior corner bolt.

18 in. x 36 in. Cover Segment:

$$\begin{aligned}A &= 18 \times 36 = 648 \text{ in}^2 \approx 650 \text{ in}^2 \\ b/a &= 36/18 = 2.0\end{aligned}$$

From Appendix B we find

$$\begin{aligned}\text{cover: } h &= 0.625 \text{ in} \\ \text{bolts: } D &= 0.750 \text{ in.} \\ N_a &= 4 \quad (\text{Spacing} = 5.25 \text{ in}) \\ N_b &= 8 \quad (\text{Spacing} = 4.82 \text{ in}) \\ \text{Maximum bolt axial stress} &= 36.0 \text{ ksi} \\ \text{Maximum bolt combined stress} &= 117.4 \text{ ksi}\end{aligned}$$

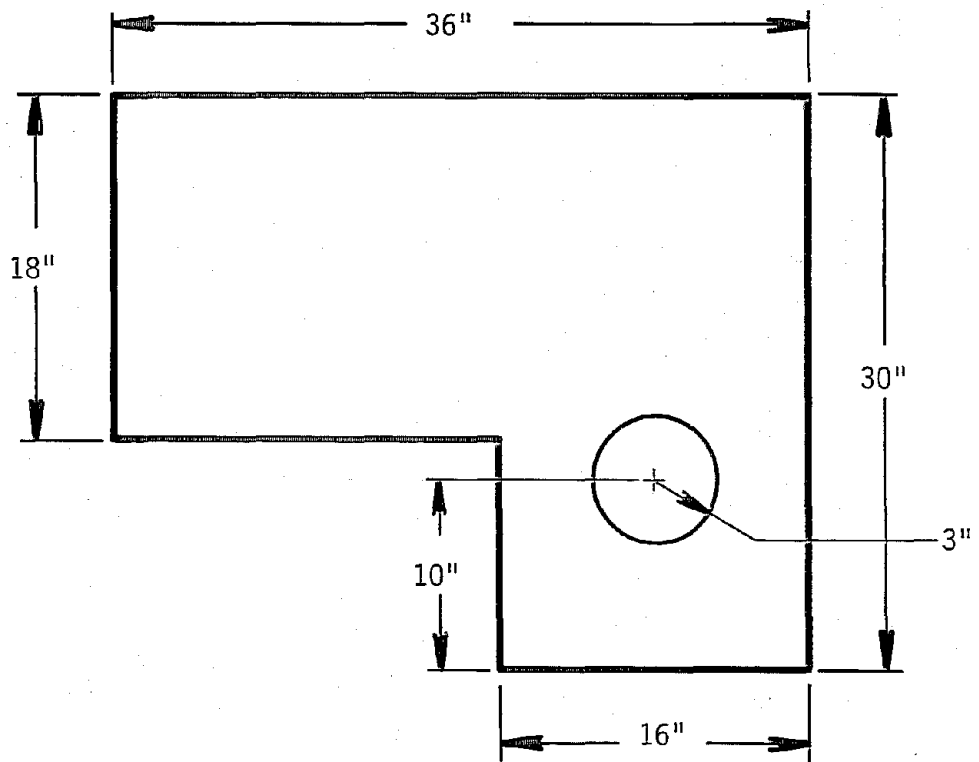


Figure 14.5. Planview of Irregular Cover

16 in x 30 in Cover Segment:

$$A = 16 \times 30 = 480 \text{ in}^2$$

$$b/a = 30/16 = 1.875$$

Using $A = 500 \text{ in}^2$ and $b/a = 2.0$ (Appendix B) we find for $h = 0.625$ & $D = 0.75$:

$$N_a = 4 \quad (\text{Spacing} = 4.58 \text{ in.})$$

$$N_b = 6 \quad (\text{Spacing} = 5.50 \text{ in.})$$

$$\text{Maximum bolt axial stress} = 34.3 \text{ ksi}$$

$$\text{Maximum bolt combined stress} = 105.9 \text{ ksi}$$

The inside corner bolt will receive the loads from both cover segments so the axial stress could reach

$$\sigma_A = 36.0 + 34.3 = 70.3 \text{ ksi} < 85.0 \text{ ksi}$$

which is O.K. The bending stresses will also combine at an angle of approximately 45° to each principal bending axis. The maximum bending stress is therefore

$$\sigma_B = (117.4 - 36) 0.707 + (105.9 - 34.3) (.707)$$

$$= 108.2 \text{ ksi}$$

$$\sigma_{\text{TOTAL}} = \sigma_A + \sigma_B = 70.3 + 108.2 = 178.5 \text{ ksi} > 120 \text{ ksi}$$

The corner bolt is over stressed; however, because the axial stress is very satisfactory, some local yielding (in bending) of the bolt at this one location is probably acceptable. This is preferable to increasing all bolt sizes or using a single larger bolt at this location.

Thread engagement: same calculation as for the rectangular enclosure example, pages 139 through 141, gives

$$L_e' = 0.877 \text{ in.}$$

which is satisfied by a 1-inch deep flange.

Window Design (Ch. 8) - The window design requires special consideration because of the high operating temperature. Thermal expansion and contraction in the window and mount must be investigated. The use of epoxy adhesive to bond the window in place will be avoided because of the high stresses produced in the glass at the glass-epoxy interface (see Figure 9.4). Therefore, to satisfy current MSHA requirements, a lead gasket must be used on the outside face of the lens (with a flame path of 1 inch) to provide an acceptable flame path. An elastomeric gasket (or sealant) is suggested on the inside surface to compensate for thermal expansion.

The glass circular window will be mounted according to Figure 8.8(b) except that the mounting ring will be on the inside of the cover. Figure 8.2 is used to determine the window thickness, for a design stress of 2000 psi (for tempered glass) as specified in 8.4.3.

Thickness:

$$\sigma_m = K_i (D_i/t)^2 p \dots \text{Figure 8.2}$$

$$K_i = 0.3025 \dots \text{for free edge (conservative)}$$

$$D_i = 6.0 \text{ in.} \dots \text{from Figure 14.5}$$

$$p = 150 \text{ psig} \dots \text{static design pressure}$$

$$\sigma_m = 2000 \text{ psi} \dots \text{allowable stress}$$

$$t = \left[\frac{(.3025)(6.0 \text{ in.})^2 (150 \text{ psi})}{2000 \text{ psi}} \right]^{1/2} = 0.904 \text{ in.}$$

Choose 7/8-inch window because of our conservative choice of K_f for a free edge condition. (A clamped edge assumption would have given $t = 0.72$ inch.)

Mounting: Mounting of the lense will be similar to that shown for the LEXAN lens in Figure 14.3. The only difference is that gaskets will be placed between the glass lens and the flanges. The flange thickness is determined from Figure 8.23. For strength it is:

$$t_f \geq \left[\frac{2V_{MAX}(2\ell - c)}{\sigma_y} \right]^{1/2} \geq 3/16 \text{ in.... Figure 8.23}$$

$V_{MAX} = 0.25$ pD....Figure 8.23

$c = 1.0$ inch....to meet MSHA flame path requirements

$\ell = c + 1/8 = 1.125$ inch...clearance for radial expansion

$D = 6.0 + 2.0 = 8.0$ inch...Window opening + seat width

$\sigma_y = 40,000$ psi.....6061-T6, Table 13.2

$$V_{MAX} = 0.25 (150 \text{ psi})(8.0 \text{ in}) = 300 \text{ lb/in.}$$

$$t_f \geq \left[\frac{2(300 \text{ lb/in})(2 \times 1.125 \text{ in.} - 1.0 \text{ in.})}{40,000 \text{ psi}} \right]^{1/2}$$

$$= 0.137 \text{ in.}$$

Therefore $t_f = 0.1875$ inch, the minimum value.

For stiffness the flange thickness must be

$$t_f \geq \left[\frac{540 V_{MAX} (2\ell - c)^2}{\pi E} \right]^{1/3} \geq 3/16 \text{ inch....Figure 8.23}$$

$$E = 10.7 \times 10^6 \text{ psi....Table 13.2}$$

$$t_f \geq \left[\frac{540 (300 \text{ lb/in}) (2 \times 1.1245 \text{ in.} - 1.0 \text{ in.})^2}{\pi (10.7 \times 10^6 \text{ psi})} \right]^{1/3}$$

$$\geq 0.196 \approx 0.20 \text{ in.} > 3/16 \text{ in.}$$

Therefore t_f for stiffness governs and

$$t_f = 0.20 \text{ in.}$$

The internal restraining ring will be designed to the same thickness. To secure the window against external loads, the bolts securing the ring will be sized to withstand V_{MAX} . For four bolts the load per bolt is

$$\frac{1}{4} (\pi D V_{MAX}) = \frac{1}{4} (\pi) (8 \text{ in.}) (300 \text{ lb/in.})$$

$$= 1885 \text{ lb}$$

Bolts will be 1/4-inch Grade 5, with UNC Class I threads, which have a proof load of

$$P_L = A_S \sigma_y = 2694 \text{ lb}$$

which is adequate.

Window Guard: MSHA requires that windows with an area greater than 8 in² be protected by location or with a window guard (Ch. 3). Section 8.5.7 gives a procedure for designing flat open-mesh guards which are welded to the enclosure so as to develop full membrane yielding.

$$h = \left[\frac{W_o^2}{16} + \frac{1}{6} \frac{qR^2}{\sigma_y} \right]^{1/2} - \frac{1}{4} W_o \dots \text{Figure 8.27}$$

Choose $W_o = 0.375 \text{ in.} \dots$ less than $0.2R$, Figure 8.27

$q = 300 \text{ psi} \dots$ Figure 8.27

$R = 4.0 \text{ inch} \dots$ assume guard extends 1 inch past window opening

$\sigma_y = 40,000 \text{ psi} \dots$ assumed yield strength for an aluminum mesh

Now

$$h = \left[\frac{(.375)^2}{16} + \frac{1}{6} \frac{(300)(4)^2}{40,000} \right]^{1/2} - .25(.375)$$

$$= 0.076 \text{ in.}$$

Thus, a mesh must be selected with openings of less than or equal to 1 inch and with an equivalent thickness of 0.076 inch.

Thermal Stresses (Ch. 9) -- Elevated temperatures can induce high stresses in the window and adjacent enclosure because of differential thermal expansion. Such stresses can influence the design of the window mounting gaskets, etc. Thermal stresses will be checked for a temperature change of

$$DT = 275^\circ\text{F} - 70^\circ\text{F} = 205^\circ\text{F}$$

Adequate allowance is made for radial expansion/contraction. Stresses will be checked in the through-thickness direction using the equation in Figure 9.1 and the geometry of Figure 9.3. For this case

$$F = \frac{(\alpha_E L_E - \alpha_W L_W - \alpha_G L_G)DT}{\frac{L_W}{A_W E_W} + \frac{L_G}{A_G E_G} + \frac{L_E}{A_E E_E}} \dots\dots \text{Figure 9.1}$$

and

$$\alpha_W = 1.8 \times 10^{-6} \text{ in/in/}^\circ\text{F} \dots\dots \text{borosilicate glass, Table 13.3}$$

$$L_W = 0.875 \text{ in} \dots\dots \text{window thickness calculated for strength}$$

$$A_W = 2 \times c \times 1 = 2 \text{ in}^2$$

$$E_W = 9.1 \times 10^{+6} \text{ psi} \dots\dots \text{Table 13.3}$$

$$\alpha_G = 16.3 \times 10^{-6} \text{ psi} \dots\dots \text{for Lead, Section 13.5}$$

$$L_G = 2 \times .125 = 0.25 \dots \text{two } 1/8\text{-inch gaskets}$$

$$A_G = c \times 1 = 1.0 \text{ in}^2$$

$$E_G = 2 \times 10^{-6} \text{ psi} \dots \text{for lead, Section 13.5}$$

$$\alpha_E = 14.3 \times 10^{-6} \text{ in/in}^\circ\text{F} \dots \text{Table 13.2}$$

$$L_E = 0.875 + 0.25 = 1.125 \text{ in.}$$

$$A_E = 2 \times c \times 1 = 2.0 \text{ in.}^2$$

$$E_E = 10.7 \times 10^{-6} \text{ psi} \dots \text{Table 13.2}$$

Now

$$F = \frac{\frac{[(14.3 \times 10^{-6})(1.125) - (1.8 \times 10^{-6})(.875)]}{0.875}}{(2.0)(9.1 \times 10^6)} + \frac{0.25}{(1.0)(2 \times 10^6)}$$

$$+ \frac{\frac{[(16.3 \times 10^{-6})(.25)] 205^\circ\text{F}}{1.125}}{(2.0)(10.7 \times 10^6)}$$

$$= \frac{.00214 \text{ in.}}{2.256 \times 10^{-7} \text{ in/lb}} = 9484 \text{ lb}$$

A positive value indicates that heating causes separation between the enclosure and the window (and gaskets) and the numerator in the equation for P shows that the gap developed is:

$$\text{gap} = .00214 \text{ inch}$$

If any gap were present at room temperature, this could cause the minimum flame gap of 0.004 inch to be exceeded. To correct the problem, a high expansion gasket is needed on one side (the inside face) of the lens. Table 13.3 shows that LEXAN or Merlon is suitable and Table 13.4 shows that epoxy or RTV is suitable. [Note that if epoxy is used it should not be bonded to the window.]

For this case, a precast epoxy gasket will be used and RTV will be used as a sealant around the outside of the window. The configuration is shown in Figure 14.6.

To calculate the new F, a fourth material (epoxy) must be added to the equation. For epoxy:

$$\alpha_G = 106 \times 10^{-6} \text{ in/in/}^\circ\text{F} \dots \text{Table 13.5}$$

$$L_G = 0.125 \text{ in} \dots \text{for } 1/8\text{-inch gasket}$$

$$A_G = c \times 1 = 1.0 \text{ in}^2$$

$$E_G \approx .10 \times 10^6 \text{ psi} \dots \text{Table 13.5}$$

Now

$$\begin{aligned} F &= \frac{\frac{14.3 \times 10^6 (1.125) - 1.8 \times 10^{-6} (.875)}{0.875}}{2(9.1 \times 10^6)} + \frac{0.125}{(1.0) (2 \times 10^6)} \\ &\quad - \frac{16.3 \times 10^{-6} (.125) - 106 \times 10^{-6} (.125)}{(1.0)(.1 \times 10^6)} + \frac{205^\circ\text{F}}{2.0(10.7 \times 10^6)} \\ &= \frac{-0.00016 \text{ in}}{1.413 \times 10^{-6} \text{ in/lb}} = -113 \text{ lb/in} \end{aligned}$$

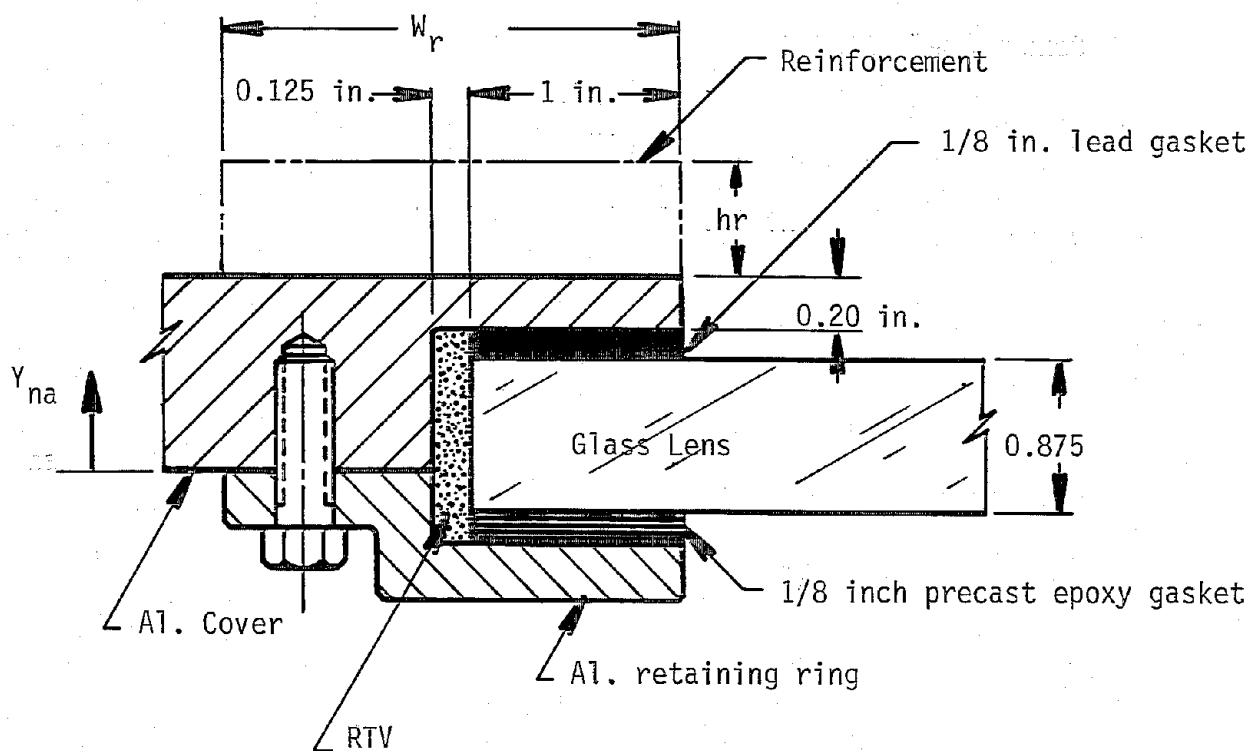


Figure 14.6. Mounting Arrangement for Glass Lens Operating at 275°F

Thus, the epoxy gaskets increase the compression in the window during heating to a value of about $1/3 V_{MAX}$, which is acceptable. For this application, precompression stresses should not exceed 200 lb/in.

Reinforcement of the Window Opening (Ch. 12) - For this opening, the reinforcing ring will be added to the outside of the cover and allowance will be made for the contribution of the inner ring. The reinforcing will be unsymmetrical and will be based on maintaining an equivalent plastic moment per Equation 12.1. The plastic moment for the area removed is

$$M_p = \sigma_y Z_p \dots \text{Equation (12.1)}$$

$$\sigma_y = 40,000 \text{ psi} \dots 6061-T6, \text{ Table 13.2}$$

$$Z_p = 1/4 ch^2 \dots \text{References 10, 11 and Figure 12.1}$$

$$\approx 1/4 (6.0 + 1.0)(.625)^2 = 0.684$$

$$M_p = (40,000 \text{ psi}) (.684 \text{ in}^3) = 27,340 \text{ in-lb}$$

A reinforcement ring must be assumed and verified. Choose (see Figure 12.1):

$$W_R = 1.5 \text{ in.}$$

$$h_r = 0.625 \text{ in.}$$

Find the neutral axis (refer to Figure 14.6):

$$\begin{aligned} \Sigma A &= 2W_R h + W_r h_r + A_{\text{ring}} \\ &= 2(1.5)(.625) + 2(.625) + 0.20(2) \\ &= 1.875 + 1.25 + 0.40 = 3.5 \text{ in}^2 \end{aligned}$$

$$\begin{aligned}
\Sigma A y &= 1.875 \left(\frac{.625}{2} \right) + 1.25 \left(.625 + \frac{.625}{2} \right) + 0.4(-.55) \\
&= .586 + 1.172 - 0.22 \\
&= 1.538 \text{ in}^3 \\
Y_{NA} &= \frac{\Sigma A y}{\Sigma A} = \frac{1.538}{3.5} = 0.44 \text{ in.}
\end{aligned}$$

Now Z_p is computed for the reinforcement and the retaining rings (on both sides of the hole) as:

$$\begin{aligned}
Z_p &= 2 \Sigma A |y| \text{ where } y \text{ is measured from } Y_{na} \\
&= 2 \left[(1.25) \left(\frac{.625}{2} + .625 - 0.44 \right) + 0.40 (.55 + .44) \right] \\
&= 2 \times 1.018 = 2.04 \text{ in}^3
\end{aligned}$$

$$M_p = \sigma_y Z_p = 40,000 (2.04) = 81,430 \text{ in lb} \gg 27,340 \text{ in lb}$$

Thus, the window is over reinforced which is adequate, for this example. Normally, the designer should iterate to find the minimum required value. Note also that the retaining ring area was not adjusted for its lower yield strength. This would slightly reduce Z_p .

Ruggedness (Ch. 7) - For this example, it is assumed that the cover is exposed to a roof fall and thus must be designed for a kinetic energy of (see Table 7.1)

$$KE = 3700 \text{ ft-lb/ft}^2$$

The unsupported cover area is approximately (Figure 14.5):

$$\begin{aligned}
A &= (36 - 4) (18 - 4) + (14 - 2) (16 - 4) \\
&= 592 \text{ in.}^2 \dots \text{adjusted for 2 inch flange width}
\end{aligned}$$

The total KE is

$$\begin{aligned} KE &= (3700 \text{ ft-lb/ft}^2)(12 \text{ in/ft})(592/144 \text{ ft}^2) \\ &= 182,533 \text{ in-lb} \end{aligned}$$

To satisfy the ruggedness requirement, the total resistance of the cover must satisfy Equation 7.3

$$h \sum_{i=1}^3 R_{m_i} \geq 182,533 \text{ in-lb} \dots \text{Equation 7.3}$$

or, a more conservative approach is to check the weakest plate segment using the equations of Table 7.2. The corner segment will be the weakest, and the equation is

$$h = \left[\frac{KE}{\sigma_y \left[(E_j^a + 11/6) \frac{a}{b} + (E_j^b + 11/6) \frac{b}{a} \right]} \right]^{1/3} \dots \text{from Table 7.2}$$

$$KE = \frac{3700(12)(18 - 4)(16 - 4)}{144}$$

$$= 51,800 \text{ in-lb} \dots \text{for the corner segment}$$

$$E_j^a = \frac{8F_y e_a N_a}{3ah^2 \sigma_y} \dots \text{Equation 11.1}$$

$$F_{yB} = A_t \sigma_y = (.334)(85,000)$$

$$= 28390 \text{ lb} \dots \text{for 3/4-inch Grade 5 Bolt with UNC}$$

$$e_a = 1.5(.750) = 1.125 \text{ in} \dots \text{edge clearance}$$

$$N_a = 4 \dots \text{from cover calculations}$$

a = 16....see Figure 14.5

h = 0.625 in....from cover calculations

σ_y = 40,000 psi....for 6061-T6 Al

Now

$$E_j^a = \frac{8(28,390 \text{ lb})(1.125)(4)}{3(16 \text{ in})(.625 \text{ in})^2(40,000 \text{ psi})} = 1.36 > 1.0$$

E_j^b will also exceed 1.0 so

$$E_j^a = E_j^b = 1.0$$

$$a/b = (16 - 4)/(18 - 4) = .86$$

$$b/a = (18 - 4)/(16 - 4) = 1.17$$

$$h = \left[\frac{51,800 \text{ in-lb}}{(40,000 \text{ psi})[(1 + 11/6)(.86) + (1 + 11/6)(1.17)]} \right]^{1/3}$$
$$= 0.608 \text{ in.} < 5/8 \text{ in.}$$

Thus, the cover satisfies the ruggedness criterion as is.

14.3.2 Summary of Design Calculations

The final specifications of the irregular cover are:

Overall Dimensions: Given in Figure 14.5

Cover Plate : 5/8-inch thick 6061-T6 aluminum

Bolts : twenty four (24) 3/4-inch diameter
Grade 5 bolts

- Window glass : 8-inch diameter window of 7/8-inch thick of borosilicate glass (PYREX)- open area is 6.0 inches in diameter
- Window mounting : Glass is mounted between 1/8-inch lead and epoxy gaskets and sealed with silicone. Flame path is 1 inch.
- Window guard : Open mesh with equivalent thickness of 0.076 inch.
- Hole Reinforcement: 5/8-inch thick external aluminum ring with 9 in. OD and 6 in. ID

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APPENDIX A

Stresses In Bolted Steel Covers

Static Design Pressure = 150 psig

Cover Properties:

$$E = 29 \times 10^6 \text{ psi}$$

$$\nu = 0.3$$

Bolt Properties:

$$E = 29 \times 10^6 \text{ psi}$$

$$\nu = 0.3$$

PLATE AREA - 50.0000

MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL		
1.0	0.250	0.250	3	3	13.08	55.60	115.59		
1.0	0.250	0.375	2	2	28.53	22.18	54.87		
1.0	0.250	0.500	2	2	29.37	9.59	42.65		
1.0	0.250	0.625	2	2	21.33	4.74	32.58		
1.0	0.250	0.750	2	2	16.82	3.05	19.91		
1.0	0.375	0.375	2	2	13.69	14.74	30.51		
1.0	0.375	0.500	2	2	12.13	9.21	23.84		
1.0	0.375	0.625	2	2	10.39	5.52	18.91		
1.2	0.250	0.250	3	2	20.72	74.53	157.02		
1.2	0.250	0.375	3	2	28.44	24.01	73.30		
1.2	0.250	0.625	2	2	22.09	4.68	33.38		
1.2	0.250	0.750	2	2	16.77	2.96	22.95		
1.2	0.375	0.250	3	2	11.06	51.94	102.77		
1.2	0.375	0.375	3	2	10.40	22.29	49.82		
1.2	0.375	0.625	2	2	10.90	5.43	18.56		
1.4	0.250	0.250	3	2	21.19	71.31	151.23		
1.4	0.250	0.375	3	2	27.76	22.94	71.06		
1.4	0.375	0.250	3	2	11.16	50.21	99.50		
1.4	0.375	0.375	3	2	10.18	21.45	48.16		
1.6	0.250	0.250	3	2	20.85	67.31	143.42		
1.6	0.250	0.375	3	2	26.29	21.72	67.65		
1.6	0.375	0.250	3	2	11.00	47.58	94.36		
1.8	0.250	0.250	3	2	20.00	63.08	134.83		
1.8	0.250	0.375	3	2	24.34	20.47	63.72		
1.8	0.375	0.250	3	2	10.70	44.59	88.45		
2.0	0.250	0.250	3	2	18.86	58.90	126.13		
2.0	0.250	0.250	4	2	15.15	44.94	94.56		
2.0	0.250	0.375	3	2	22.27	19.26	59.61		
2.0	0.375	0.250	3	2	10.30	41.52	82.35		

PLATE AREA - 100.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.0	0.250	0.375	3	3	32.16	50.07	125.62	1.8	0.375	0.250	4	3	17.67	89.71	175.99	1.8	0.375	0.250	4
1.0	0.250	0.500	3	3	36.32	19.64	82.29	1.8	0.375	0.250	5	3	15.38	86.13	168.99	1.8	0.375	0.250	5
1.0	0.250	0.625	3	3	31.54	8.41	66.02	1.8	0.375	0.375	4	3	11.77	35.02	74.01	1.8	0.375	0.375	4
1.0	0.375	0.250	4	4	16.31	80.88	158.39	1.8	0.375	0.375	5	3	10.37	31.73	67.67	1.8	0.375	0.375	5
1.0	0.375	0.375	3	3	12.03	46.60	97.54	1.8	0.375	0.500	3	2	21.55	24.38	66.05	1.8	0.375	0.500	3
1.0	0.375	0.500	3	3	15.45	20.96	53.24	1.8	0.375	0.625	3	2	18.93	12.57	45.58	1.8	0.375	0.625	3
1.0	0.375	0.625	3	3	15.46	10.54	36.84	1.8	0.375	0.750	3	2	13.55	7.26	31.56	1.8	0.375	0.750	3
1.0	0.500	0.250	3	3	11.10	77.42	150.45	1.8	0.500	0.250	4	3	12.92	61.23	119.00	1.8	0.500	0.250	4
1.0	0.500	0.250	4	3	11.41	71.73	139.35	1.8	0.500	0.250	5	3	11.72	61.24	119.03	1.8	0.500	0.250	5
1.0	0.500	0.250	4	4	11.18	71.73	139.35	1.8	0.500	0.500	3	2	10.18	22.75	50.83	1.8	0.500	0.500	3
1.0	0.500	0.250	4	4	11.51	58.01	112.76	1.8	0.500	0.625	3	2	10.09	12.73	33.31	1.8	0.500	0.625	3
1.2	0.250	0.375	3	3	37.49	51.71	134.32	2.0	0.250	0.375	4	2	24.98	40.27	103.42	2.0	0.250	0.375	4
1.2	0.250	0.375	4	3	22.22	37.29	94.27	2.0	0.250	0.375	5	2	21.85	32.59	86.15	2.0	0.250	0.375	5
1.2	0.375	0.250	4	3	17.22	94.18	184.47	2.0	0.250	0.500	4	2	21.92	16.22	63.16	2.0	0.250	0.500	4
1.2	0.375	0.375	3	3	14.13	48.40	102.47	2.0	0.250	0.625	4	2	18.95	7.75	43.50	2.0	0.250	0.625	4
1.2	0.375	0.375	4	3	11.95	35.62	74.80	2.0	0.250	0.750	3	2	28.05	5.99	42.50	2.0	0.250	0.750	3
1.2	0.500	0.250	3	3	12.45	80.72	156.96	2.0	0.375	0.250	4	3	17.18	86.12	168.98	2.0	0.375	0.250	4
1.2	0.500	0.250	4	3	12.56	65.57	127.44	2.0	0.375	0.250	5	3	14.87	82.49	161.73	2.0	0.375	0.250	5
1.4	0.250	0.375	3	3	40.47	51.89	138.06	2.0	0.375	0.375	4	2	13.34	37.74	79.83	2.0	0.375	0.375	4
1.4	0.250	0.375	4	3	23.42	37.90	96.74	2.0	0.375	0.375	5	2	11.55	31.61	67.11	2.0	0.375	0.375	5
1.4	0.375	0.250	4	3	17.92	94.48	185.19	2.0	0.375	0.500	4	2	10.53	17.12	42.81	2.0	0.375	0.500	4
1.4	0.375	0.375	3	3	15.25	48.64	103.79	2.0	0.375	0.750	3	2	12.55	6.97	28.61	2.0	0.375	0.750	3
1.4	0.375	0.375	4	3	12.34	36.07	75.99	2.0	0.500	0.250	4	3	12.59	58.21	113.11	2.0	0.500	0.250	4
1.4	0.500	0.250	3	3	13.13	80.42	156.42	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5
1.4	0.500	0.250	4	3	13.05	65.51	127.33	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5
1.6	0.250	0.375	3	3	41.51	51.03	137.92	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5
1.6	0.250	0.375	4	3	23.72	37.75	96.89	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5
1.6	0.250	0.750	3	2	32.84	6.06	54.22	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5
1.6	0.375	0.250	4	3	17.97	92.69	181.77	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5
1.6	0.375	0.375	3	3	15.59	47.79	102.47	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5
1.6	0.375	0.375	4	3	12.19	35.76	75.51	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5
1.6	0.375	0.750	3	2	15.32	7.93	34.72	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5
1.6	0.500	0.250	4	3	13.36	77.85	151.44	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5
1.6	0.500	0.250	4	3	13.12	63.82	124.04	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5
1.8	0.250	0.375	4	3	23.42	37.15	95.59	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5
1.8	0.250	0.375	5	3	23.08	33.17	88.33	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5
1.8	0.250	0.500	3	2	49.99	22.37	107.89	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5
1.8	0.250	0.625	3	2	36.71	10.36	78.62	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5
1.8	0.250	0.750	3	2	30.46	6.06	47.92	2.0	0.500	0.250	5	3	11.39	58.09	112.83	2.0	0.500	0.250	5

PLATE AREA - 150.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL				
1.0	0.250	0.375	4	3	28.87	80.77	186.62	1.2	0.500	0.375	4	3	12.92	56.66	112.31				
1.0	0.250	0.375	3	4	33.62	80.77	186.62	1.2	0.500	0.375	5	3	11.69	53.06	105.87				
1.0	0.250	0.375	4	4	35.74	57.12	134.33	1.2	0.500	0.375	4	4	13.64	51.77	102.85				
1.0	0.250	0.500	3	3	51.88	36.96	133.31	1.2	0.500	0.375	5	3	12.35	50.72	100.97				
1.0	0.250	0.625	3	3	52.64	15.88	110.90	1.2	0.500	0.500	3	3	12.37	37.61	80.54				
1.0	0.250	0.750	3	3	42.96	6.98	93.91	1.2	0.500	0.625	3	3	14.62	20.54	51.37				
1.0	0.375	0.375	3	3	15.87	85.63	175.39	1.2	0.500	0.750	3	3	14.60	12.06	37.69				
1.0	0.375	0.375	4	3	15.93	74.88	152.74	1.2	0.625	0.250	4	3	14.15	79.87	154.84				
1.0	0.375	0.375	3	4	14.92	74.88	152.74	1.2	0.625	0.250	5	3	13.38	83.40	161.76				
1.0	0.375	0.375	4	4	18.34	54.63	112.14	1.2	0.625	0.250	4	4	14.13	76.47	148.28				
1.0	0.375	0.500	3	3	21.73	38.57	92.08	1.2	0.625	0.250	5	4	13.38	80.78	156.65				
1.0	0.375	0.625	3	3	24.19	19.45	62.38	1.2	0.625	0.375	4	3	10.22	46.00	89.98				
1.0	0.375	0.750	3	3	23.04	10.53	49.50	1.2	0.625	0.375	4	4	10.41	42.52	83.28				
1.0	0.500	0.375	3	3	10.17	71.61	141.77	1.2	0.750	0.250	4	3	10.76	53.19	103.04				
1.0	0.500	0.375	4	3	11.54	63.51	125.48	1.2	0.750	0.250	5	3	10.36	56.83	110.10				
1.0	0.500	0.375	3	4	11.03	63.51	125.48	1.2	0.750	0.250	4	4	10.72	51.64	100.04				
1.0	0.500	0.375	4	4	12.37	48.09	95.29	1.2	0.750	0.250	5	4	10.32	55.54	107.61				
1.0	0.500	0.500	3	3	10.58	36.13	76.42	1.4	0.250	0.375	4	3	34.39	69.77	166.32				
1.0	0.500	0.625	3	3	12.78	19.60	47.84	1.4	0.250	0.375	5	3	33.96	63.43	157.12				
1.0	0.500	0.750	3	3	13.08	11.39	34.94	1.4	0.250	0.375	4	4	40.19	65.63	159.18				
1.0	0.625	0.250	3	3	12.79	91.23	176.89	1.4	0.250	0.375	5	4	35.42	63.61	155.10				
1.0	0.625	0.250	4	3	12.91	86.80	168.26	1.4	0.250	0.500	4	3	36.16	27.86	102.65				
1.0	0.625	0.250	3	4	12.76	86.80	168.26	1.4	0.250	0.625	4	3	34.10	12.26	83.45				
1.0	0.625	0.250	4	4	12.90	72.48	140.53	1.4	0.250	0.750	4	3	32.01	5.89	67.68				
1.2	0.250	0.375	4	3	33.29	68.92	162.50	1.4	0.375	0.375	4	3	18.76	65.94	136.00				
1.2	0.250	0.375	5	3	33.02	68.79	154.70	1.4	0.375	0.375	5	3	16.59	60.61	126.47				
1.2	0.250	0.375	4	4	39.50	62.86	150.70	1.4	0.375	0.375	4	4	20.80	61.63	127.83				
1.2	0.250	0.375	5	4	35.19	61.64	149.57	1.4	0.375	0.375	5	4	18.35	59.64	123.81				
1.2	0.250	0.500	3	3	60.00	37.97	146.66	1.4	0.375	0.500	4	3	15.71	29.39	71.04				
1.2	0.250	0.625	3	3	59.30	16.34	124.08	1.4	0.375	0.625	4	3	16.24	14.87	47.82				
1.2	0.250	0.750	3	3	46.57	7.48	102.68	1.4	0.375	0.750	4	3	14.53	8.20	37.16				
1.2	0.375	0.375	4	3	18.10	67.08	135.52	1.4	0.500	0.375	4	3	13.42	57.01	113.15				
1.2	0.375	0.375	5	3	16.30	62.10	125.62	1.4	0.500	0.375	5	3	11.95	53.59	106.89				
1.2	0.375	0.375	4	4	20.26	59.43	122.78	1.4	0.500	0.375	4	4	14.12	53.26	105.97				
1.2	0.375	0.375	5	4	18.14	57.84	119.98	1.4	0.500	0.375	5	4	12.60	52.01	103.51				
1.2	0.375	0.500	3	3	25.26	40.01	98.18	1.4	0.500	0.500	4	3	10.36	28.03	59.64				
1.2	0.375	0.625	3	3	27.56	20.31	68.25	1.4	0.625	0.250	4	4	14.68	79.54	154.20				
1.2	0.375	0.750	3	3	25.57	11.14	54.67	1.4	0.625	0.250	5	3	13.80	82.93	160.81				

PLATE AREA - 150.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.4	0.625	0.250	4	4	14.68	76.87	149.05	1.8	0.750	0.250	5	3	10.50	51.37	99.44	1.8	0.750	0.250	5
1.4	0.625	0.250	5	4	13.82	80.95	156.95	1.8	0.750	0.250	6	3	10.15	47.08	91.17	2.0	0.250	0.375	4
1.4	0.625	0.375	4	3	10.62	46.12	90.27	2.0	0.250	0.375	5	3	32.75	66.29	160.75	2.0	0.250	0.375	5
1.4	0.625	0.375	4	4	10.82	43.40	85.05	2.0	0.250	0.375	6	3	29.88	60.04	146.93	2.0	0.250	0.375	6
1.4	0.750	0.250	4	3	11.15	52.88	102.42	2.0	0.250	0.375	4	3	29.96	45.91	119.44	2.0	0.375	0.375	5
1.4	0.750	0.250	5	3	10.69	56.37	109.20	2.0	0.375	0.375	4	3	17.27	61.87	128.33	2.0	0.375	0.375	5
1.4	0.750	0.250	4	4	11.12	51.66	100.07	2.0	0.375	0.375	5	3	14.65	56.66	117.58	2.0	0.375	0.375	6
1.4	0.750	0.250	5	4	10.67	55.39	107.29	2.0	0.375	0.375	6	3	14.04	44.51	94.36	2.0	0.500	0.375	6
1.6	0.250	0.375	4	3	33.70	69.28	166.45	2.0	0.500	0.250	6	3	16.02	92.39	179.66	2.0	0.500	0.250	4
1.6	0.250	0.375	5	3	33.35	63.14	156.12	2.0	0.500	0.375	4	3	12.73	52.60	104.56	2.0	0.500	0.375	5
1.6	0.250	0.500	4	3	36.11	27.86	102.94	2.0	0.500	0.375	5	3	11.00	49.24	97.85	2.0	0.500	0.375	6
1.6	0.375	0.375	4	3	18.59	65.24	134.90	2.0	0.500	0.375	6	3	10.31	39.92	80.09	2.0	0.625	0.250	4
1.6	0.375	0.375	5	3	16.19	60.06	125.19	2.0	0.625	0.250	5	3	13.17	69.33	134.34	2.0	0.625	0.250	6
1.6	0.375	0.500	4	3	15.78	29.29	71.00	2.0	0.625	0.250	6	3	12.55	64.32	124.69	2.0	0.750	0.250	4
1.6	0.500	0.375	4	3	13.41	56.13	111.51	2.0	0.625	0.375	4	3	10.21	41.76	81.72	2.0	0.750	0.250	5
1.6	0.500	0.375	5	3	11.79	52.79	105.20	2.0	0.750	0.250	5	3	10.18	48.09	93.07	4.0	0.250	0.250	7
1.6	0.500	0.500	4	3	10.21	27.83	59.29	4.0	0.250	0.250	8	2	21.56	94.93	192.46	4.0	0.250	0.250	8
1.6	0.625	0.250	4	3	14.74	77.07	149.39	4.0	0.250	0.375	6	2	17.43	44.24	101.80	4.0	0.250	0.375	7
1.6	0.625	0.250	5	3	13.80	80.19	155.45	4.0	0.250	0.375	7	2	16.95	31.17	78.42	4.0	0.250	0.375	8
1.6	0.625	0.375	4	3	10.66	45.17	88.43	4.0	0.250	0.500	5	2	15.55	18.34	57.59	4.0	0.250	0.500	6
1.6	0.750	0.250	4	3	11.17	51.06	98.88	4.0	0.250	0.500	6	2	15.96	13.91	48.14	4.0	0.250	0.500	7
1.6	0.750	0.250	5	3	10.70	54.29	105.14	4.0	0.250	0.625	5	2	14.40	9.10	37.25	4.0	0.250	0.625	6
1.8	0.250	0.375	4	3	33.15	68.00	164.26	4.0	0.250	0.625	6	2	14.53	6.97	30.90	4.0	0.375	0.250	5
1.8	0.250	0.375	5	3	31.83	61.84	152.24	4.0	0.375	0.250	5	2	16.51	94.29	183.27	4.0	0.375	0.250	6
1.8	0.250	0.375	6	3	31.36	47.17	123.16	4.0	0.375	0.250	6	2	15.47	78.43	153.14	4.0	0.375	0.250	7
1.8	0.375	0.375	4	3	18.01	63.76	132.09	4.0	0.375	0.250	8	2	13.50	63.36	124.34	4.0	0.375	0.250	9
1.8	0.375	0.375	5	3	15.47	58.60	121.89	4.0	0.375	0.250	9	2	10.98	39.77	80.27	4.0	0.375	0.250	10
1.8	0.375	0.375	6	3	14.88	45.93	97.53	4.0	0.375	0.250	10	2	10.39	30.95	64.01	4.0	0.375	0.250	11
1.8	0.500	0.250	6	3	16.53	97.17	189.00	4.0	0.500	0.250	11	2	12.13	59.46	114.98	4.0	0.500	0.250	12
1.8	0.500	0.375	4	3	13.13	54.55	108.42	4.0	0.500	0.250	12	2	11.45	52.56	101.83	4.0	0.500	0.250	13
1.8	0.500	0.375	5	3	11.44	51.21	101.92	4.0	0.500	0.250	13	2	10.80	49.81	96.58	4.0	0.500	0.250	14
1.8	0.500	0.375	6	3	10.77	41.42	83.20	4.0	0.500	0.250	14	2	10.28	45.44	88.22	4.0	0.500	0.250	15
1.8	0.625	0.250	4	3	14.50	73.46	142.36	4.0	0.625	0.250	15	2	10.28	45.44	88.22	4.0	0.625	0.250	16
1.8	0.625	0.250	5	3	13.56	76.23	147.72	4.0	0.625	0.250	16	2	10.28	45.44	88.22	4.0	0.625	0.250	17
1.8	0.625	0.250	6	3	12.93	68.14	132.15	4.0	0.625	0.250	17	2	10.28	45.44	88.22	4.0	0.625	0.250	18
1.8	0.625	0.375	4	3	10.49	43.62	85.38	4.0	0.625	0.250	18	2	10.28	45.44	88.22	4.0	0.625	0.250	19
1.8	0.750	0.250	4	3	10.98	48.46	93.83	4.0	0.750	0.250	19	2	10.28	45.44	88.22	4.0	0.750	0.250	20

PLATE AREA - 200.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.0	0.500	0.375	4	4	16.71	74.04	146.04	1.4	0.500	0.625	4	3	12.03	23.12	54.83	1.4	0.500	0.625	4
1.0	0.500	0.375	5	4	15.32	72.90	144.13	1.4	0.500	0.750	4	3	12.00	13.47	38.85	1.4	0.500	0.750	4
1.0	0.500	0.375	4	5	15.02	72.90	144.13	1.4	0.625	0.375	4	3	14.22	70.82	138.35	1.4	0.625	0.375	4
1.0	0.500	0.375	5	5	13.83	69.44	137.34	1.4	0.625	0.375	5	3	12.78	68.95	134.94	1.4	0.625	0.375	5
1.0	0.500	0.500	4	4	13.49	35.43	73.83	1.4	0.625	0.375	6	3	12.10	57.59	113.09	1.4	0.625	0.375	6
1.0	0.500	0.625	4	4	11.80	18.73	44.25	1.4	0.625	0.375	4	4	14.55	66.66	130.37	1.4	0.625	0.375	4
1.0	0.500	0.750	3	3	17.93	17.54	50.61	1.4	0.625	0.375	5	4	13.12	66.65	130.33	1.4	0.625	0.375	5
1.0	0.625	0.375	4	4	12.72	61.26	119.64	1.4	0.625	0.375	6	4	12.46	55.52	109.03	1.4	0.625	0.375	6
1.0	0.625	0.375	5	4	11.82	61.43	120.13	1.4	0.625	0.500	4	3	10.71	38.81	78.09	1.4	0.625	0.500	4
1.0	0.625	0.375	4	5	11.62	61.43	120.13	1.4	0.750	0.375	4	3	11.59	54.95	106.82	1.4	0.750	0.375	4
1.0	0.625	0.375	5	5	10.85	58.29	114.02	1.4	0.750	0.375	5	3	10.63	55.03	107.10	1.4	0.750	0.375	5
1.0	0.625	0.750	3	3	10.75	17.37	41.68	1.4	0.750	0.375	6	3	10.09	47.37	92.37	1.4	0.750	0.375	6
1.0	0.750	0.375	4	4	10.21	48.63	94.55	1.4	0.750	0.375	4	4	11.66	52.28	101.69	1.4	0.750	0.375	4
1.2	0.500	0.375	4	3	17.31	88.05	172.72	1.4	0.750	0.375	5	4	10.73	53.30	103.67	1.4	0.750	0.375	5
1.2	0.500	0.375	5	3	15.53	82.05	162.66	1.6	0.500	0.375	4	3	18.02	86.09	170.21	1.6	0.500	0.375	4
1.2	0.500	0.375	4	4	18.41	79.57	157.29	1.6	0.500	0.375	5	3	15.69	81.50	161.47	1.6	0.500	0.375	5
1.2	0.500	0.375	5	4	16.54	78.52	155.37	1.6	0.500	0.375	6	3	14.86	65.82	131.29	1.6	0.500	0.375	6
1.2	0.500	0.500	4	3	13.48	42.48	88.59	1.6	0.500	0.375	4	4	19.03	81.65	161.76	1.6	0.500	0.375	4
1.2	0.500	0.625	4	3	11.75	22.70	53.61	1.6	0.500	0.375	5	4	16.63	79.84	157.93	1.6	0.500	0.375	5
1.2	0.500	0.750	4	3	11.94	13.11	37.97	1.6	0.500	0.500	4	3	13.78	42.57	89.32	1.6	0.500	0.500	4
1.2	0.625	0.375	5	3	13.67	70.68	138.02	1.6	0.500	0.500	5	3	12.19	38.83	82.46	1.6	0.500	0.500	5
1.2	0.625	0.375	4	4	12.45	68.72	134.53	1.6	0.500	0.625	4	3	11.72	23.06	54.72	1.6	0.500	0.625	4
1.2	0.625	0.375	5	4	14.00	65.36	127.75	1.6	0.500	0.625	5	3	12.24	20.44	50.49	1.6	0.500	0.625	5
1.2	0.625	0.375	4	3	12.78	65.54	128.19	1.6	0.500	0.625	4	3	11.57	13.52	38.64	1.6	0.500	0.625	4
1.2	0.625	0.500	4	3	10.34	38.48	77.26	1.6	0.500	0.750	4	3	14.28	69.32	135.46	1.6	0.500	0.750	4
1.2	0.750	0.375	4	3	11.16	54.99	106.89	1.6	0.625	0.375	4	3	12.72	67.46	131.95	1.6	0.625	0.375	4
1.2	0.750	0.375	5	3	10.33	55.09	107.25	1.6	0.625	0.375	5	3	11.96	56.32	110.56	1.6	0.625	0.375	5
1.2	0.750	0.375	4	4	11.21	51.60	100.36	1.6	0.625	0.375	6	3	14.61	66.09	129.28	1.6	0.625	0.375	6
1.2	0.750	0.375	5	4	10.41	52.76	102.65	1.6	0.625	0.375	4	4	13.06	65.79	128.58	1.6	0.625	0.375	4
1.4	0.500	0.375	4	3	18.01	87.51	172.88	1.6	0.625	0.375	5	4	12.32	54.87	107.73	1.6	0.625	0.375	5
1.4	0.500	0.375	5	3	15.89	82.80	164.13	1.6	0.625	0.500	4	3	10.67	38.31	77.11	1.6	0.625	0.500	4
1.4	0.500	0.375	6	3	15.15	66.93	133.53	1.6	0.750	0.375	4	3	11.65	53.54	104.07	1.6	0.750	0.375	4
1.4	0.500	0.375	4	4	19.06	81.76	161.84	1.6	0.750	0.375	5	3	10.62	53.56	104.17	1.6	0.750	0.375	5
1.4	0.500	0.375	5	4	16.86	80.41	159.12	1.6	0.750	0.375	6	3	10.02	46.11	89.87	1.6	0.750	0.375	6
1.4	0.500	0.375	6	4	16.13	64.65	129.01	1.6	0.750	0.375	4	4	11.73	51.47	100.11	1.6	0.750	0.375	4
1.4	0.500	0.500	4	3	13.94	42.97	89.93												

PLATE AREA - 200.0000

MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL		
1.6	0.750	0.375	5	4	10.73	52.27	101.62		
1.6	0.750	0.375	6	4	10.15	44.97	87.67		
1.8	0.500	0.375	4	3	17.66	83.59	165.39		
1.8	0.500	0.375	5	3	15.23	79.02	156.42		
1.8	0.500	0.375	6	3	14.34	63.88	127.36		
1.8	0.500	0.375	4	4	18.61	80.13	158.82		
1.8	0.500	0.375	5	4	16.11	77.83	153.85		
1.8	0.500	0.375	6	4	15.18	62.95	125.92		
1.8	0.500	0.500	4	3	13.32	41.66	87.53		
1.8	0.500	0.500	5	3	11.64	37.92	80.25		
1.8	0.500	0.625	4	3	11.30	22.70	53.81		
1.8	0.500	0.625	5	3	11.25	20.05	48.98		
1.8	0.500	0.750	4	3	10.87	13.40	37.79		
1.8	0.500	0.750	5	3	11.15	11.46	34.70		
1.8	0.625	0.375	4	3	14.06	66.90	130.75		
1.8	0.625	0.375	5	3	12.44	64.99	127.04		
1.8	0.625	0.375	6	3	11.64	54.33	106.61		
1.8	0.625	0.375	4	4	14.38	64.39	125.95		
1.8	0.625	0.375	5	4	12.78	63.76	124.54		
1.8	0.625	0.375	6	4	11.98	53.33	104.65		
1.8	0.625	0.500	4	3	10.42	37.33	75.16		
1.8	0.750	0.375	4	3	11.47	51.37	99.85		
1.8	0.750	0.375	5	3	10.42	51.29	99.70		
1.8	0.750	0.375	4	4	11.57	49.77	96.79		
1.8	0.750	0.375	5	4	10.54	50.34	97.80		
2.0	0.500	0.375	5	3	14.64	75.94	150.17		
2.0	0.500	0.375	6	3	13.72	61.52	122.59		
2.0	0.500	0.375	7	3	13.04	54.58	109.46		
2.0	0.500	0.500	5	3	11.02	36.69	77.36		
2.0	0.500	0.625	5	3	10.16	19.49	47.02		
2.0	0.625	0.375	5	3	12.06	62.04	121.19		
2.0	0.625	0.375	6	3	11.24	52.00	101.98		
2.0	0.625	0.375	7	3	10.61	47.31	93.08		
2.0	0.750	0.375	5	3	10.13	48.65	94.51		
4.0	0.500	0.375	6	2	10.27	40.11	79.13		

PLATE AREA - 250.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.0	0.500	0.375	5	5	17.28	97.49	192.12	1.2	0.875	0.375	5	4	10.82	58.17	112.86	1.4	0.500	0.375	6
1.0	0.500	0.500	4	4	17.12	49.57	102.07	1.2	0.875	0.375	6	4	10.41	51.29	99.65	1.4	0.500	0.375	6
1.0	0.500	0.625	4	4	15.03	26.23	60.22	1.2	0.875	0.375	4	5	10.97	53.70	104.17	1.4	0.500	0.500	4
1.0	0.500	0.750	4	4	13.78	15.06	41.84	1.2	0.875	0.375	5	5	10.36	56.29	109.25	1.4	0.500	0.500	5
1.0	0.625	0.375	4	4	16.01	85.58	166.93	1.4	0.500	0.375	6	4	20.22	90.59	179.82	1.4	0.500	0.375	6
1.0	0.625	0.375	5	4	14.82	86.18	168.26	1.4	0.500	0.375	6	5	19.07	89.20	176.98	1.4	0.500	0.375	6
1.0	0.625	0.375	4	5	14.58	86.18	168.26	1.4	0.500	0.500	4	3	17.55	59.90	123.91	1.4	0.500	0.500	4
1.0	0.625	0.375	5	5	13.57	81.78	159.70	1.4	0.500	0.500	5	3	15.57	54.95	115.14	1.4	0.500	0.500	5
1.0	0.625	0.500	4	4	12.55	45.35	90.51	1.4	0.500	0.625	4	3	15.13	32.22	74.47	1.4	0.500	0.625	4
1.0	0.625	0.625	4	4	10.61	25.33	53.51	1.4	0.500	0.625	5	3	15.26	28.84	69.37	1.4	0.500	0.625	5
1.0	0.750	0.375	4	4	12.82	67.92	131.99	1.4	0.625	0.375	4	3	16.89	16.35	49.61	1.4	0.625	0.375	4
1.0	0.750	0.375	5	4	12.03	69.79	135.72	1.4	0.625	0.375	4	4	18.29	93.02	181.66	1.4	0.625	0.375	4
1.0	0.750	0.375	4	5	11.88	69.79	135.72	1.4	0.625	0.375	5	4	16.44	93.39	182.34	1.4	0.625	0.375	5
1.0	0.750	0.375	5	5	11.21	66.47	129.28	1.4	0.625	0.375	6	4	15.61	77.74	152.33	1.4	0.625	0.375	6
1.0	0.750	0.500	4	4	10.01	39.98	78.68	1.4	0.625	0.375	4	5	17.32	89.60	174.91	1.4	0.625	0.375	4
1.0	0.875	0.375	4	4	10.49	52.70	102.24	1.4	0.625	0.375	5	5	15.64	90.66	177.06	1.4	0.625	0.375	5
1.2	0.500	0.375	6	4	20.04	88.40	175.41	1.4	0.625	0.375	6	5	14.87	76.04	148.96	1.4	0.625	0.375	6
1.2	0.500	0.375	6	5	18.54	86.44	171.42	1.4	0.625	0.375	6	5	14.87	76.04	148.96	1.4	0.625	0.375	6
1.2	0.500	0.500	4	4	18.91	53.97	111.86	1.4	0.625	0.500	4	3	13.47	54.09	108.17	1.4	0.625	0.500	4
1.2	0.500	0.625	4	4	16.67	28.95	67.38	1.4	0.625	0.500	5	3	11.99	50.43	101.51	1.4	0.625	0.500	5
1.2	0.500	0.750	4	4	15.35	16.81	47.62	1.4	0.625	0.625	4	3	11.08	30.85	65.38	1.4	0.625	0.625	4
1.2	0.625	0.375	4	4	17.60	91.24	178.11	1.4	0.625	0.625	5	3	10.07	27.88	60.39	1.4	0.625	0.625	5
1.2	0.625	0.375	5	4	16.02	91.89	179.44	1.4	0.625	0.750	5	3	10.32	16.46	40.73	1.4	0.625	0.750	5
1.2	0.625	0.375	6	4	15.35	76.51	149.92	1.4	0.750	0.375	4	4	14.63	72.96	141.87	1.4	0.750	0.375	4
1.2	0.625	0.375	4	5	16.40	86.98	169.73	1.4	0.750	0.375	5	4	13.43	74.65	145.13	1.4	0.750	0.375	5
1.2	0.625	0.375	5	5	15.01	88.34	172.55	1.4	0.750	0.375	6	4	12.78	64.12	124.91	1.4	0.750	0.375	6
1.2	0.625	0.375	6	5	14.40	74.22	145.40	1.4	0.750	0.375	4	5	13.98	70.51	137.06	1.4	0.750	0.375	4
1.2	0.625	0.375	4	4	13.85	48.97	98.04	1.4	0.750	0.375	5	5	12.89	72.53	141.04	1.4	0.750	0.375	5
1.2	0.625	0.500	4	4	11.75	27.73	59.00	1.4	0.750	0.375	6	5	12.27	62.62	121.98	1.4	0.750	0.375	6
1.2	0.625	0.625	4	4	10.53	16.74	39.79	1.4	0.750	0.500	4	3	11.11	46.90	92.36	1.4	0.750	0.500	4
1.2	0.750	0.375	4	4	14.07	72.03	140.05	1.4	0.875	0.375	4	4	11.95	56.11	108.85	1.4	0.875	0.375	4
1.2	0.750	0.375	5	4	13.03	73.92	143.75	1.4	0.875	0.375	5	4	11.17	58.43	113.34	1.4	0.875	0.375	5
1.2	0.750	0.375	6	4	12.49	63.53	123.80	1.4	0.875	0.375	6	4	10.69	51.49	100.02	1.4	0.875	0.375	6
1.2	0.750	0.375	4	5	13.27	68.98	134.08	1.4	0.875	0.375	4	5	11.52	54.51	105.74	1.4	0.875	0.375	4
1.2	0.750	0.375	5	5	12.35	71.20	138.48	1.4	0.875	0.375	5	5	10.80	56.97	110.52	1.4	0.875	0.375	5
1.2	0.750	0.375	6	5	11.86	61.97	119.95	1.4	0.875	0.375	6	5	10.35	50.37	97.84	1.4	0.875	0.375	6
1.2	0.750	0.500	4	4	11.04	42.87	84.50	1.6	0.500	0.375	6	3	18.56	92.16	182.90	1.6	0.500	0.375	6
1.2	0.875	0.375	4	4	11.49	55.69	108.04	1.6	0.500	0.375	6	3	18.56	92.16	182.90	1.6	0.500	0.375	6

PLATE AREA - 250.0000

MAXIMUM STRESSES								MAXIMUM STRESSES							
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	0.500	0.375	7	3	17.80	82.43	164.56	1.8	0.625	0.375	7	4	14.24	68.41	134.25
1.6	0.500	0.375	6	4	19.77	90.13	178.90	1.8	0.625	0.500	5	3	11.41	48.35	97.08
1.6	0.500	0.375	7	4	19.00	81.38	162.17	1.8	0.750	0.375	5	3	13.02	71.77	139.47
1.6	0.500	0.500	5	3	15.19	54.47	113.97	1.8	0.750	0.375	6	3	12.25	61.87	120.45
1.6	0.500	0.625	5	3	14.96	28.73	68.73	1.8	0.750	0.375	7	3	11.62	57.84	112.79
1.6	0.500	0.750	4	3	15.00	18.77	52.07	1.8	0.750	0.375	5	4	13.19	70.46	136.86
1.6	0.500	0.750	5	3	15.93	16.38	48.85	1.8	0.750	0.375	6	4	12.43	60.75	118.27
1.6	0.625	0.375	5	3	15.89	94.43	184.45	1.8	0.750	0.375	7	4	11.81	57.00	111.11
1.6	0.625	0.375	6	3	14.94	78.81	154.38	1.8	0.875	0.375	5	3	10.95	55.41	107.42
1.6	0.625	0.375	7	3	14.22	72.13	141.72	1.8	0.875	0.375	6	3	10.39	49.02	95.14
1.6	0.625	0.375	5	4	16.36	92.13	179.83	1.8	0.875	0.375	5	4	11.01	54.52	105.68
1.6	0.625	0.375	6	4	15.42	76.81	150.48	1.8	0.875	0.375	6	4	10.46	48.23	93.62
1.6	0.625	0.375	7	4	14.71	70.84	139.07								
1.6	0.625	0.500	5	3	11.80	49.76	100.05	2.0	0.500	0.375	6	3	17.15	86.08	170.72
1.6	0.750	0.375	5	3	13.27	74.96	145.73	2.0	0.500	0.375	7	3	16.29	76.41	152.35
1.6	0.750	0.375	6	3	12.52	64.50	125.62	2.0	0.500	0.375	8	3	15.65	66.19	132.71
1.6	0.750	0.375	7	3	11.93	60.43	117.90	2.0	0.500	0.375	6	4	18.15	85.29	169.17
1.6	0.750	0.375	5	4	13.43	73.19	142.23	2.0	0.500	0.375	7	4	17.28	75.66	150.67
1.6	0.750	0.375	6	4	12.70	62.94	122.58	2.0	0.500	0.375	8	4	16.61	65.75	131.74
1.6	0.750	0.375	7	4	12.12	59.30	115.63	2.0	0.500	0.500	5	3	13.74	51.40	107.02
1.6	0.875	0.375	5	3	11.15	58.16	112.80	2.0	0.500	0.500	6	3	13.17	40.38	85.99
1.6	0.875	0.375	6	3	10.61	51.35	99.70	2.0	0.500	0.625	5	3	12.75	27.34	64.33
1.6	0.875	0.375	7	3	10.15	49.13	95.49	2.0	0.500	0.625	6	3	13.05	21.15	52.47
1.6	0.875	0.375	5	4	11.19	56.96	110.46	2.0	0.500	0.750	5	3	13.09	15.72	44.90
1.6	0.875	0.375	6	4	10.67	50.26	97.60	2.0	0.500	0.750	6	3	13.13	12.01	37.62
1.6	0.875	0.375	7	4	10.22	48.28	93.82	2.0	0.625	0.375	5	3	15.06	86.81	169.36
								2.0	0.625	0.375	6	3	14.04	72.73	142.36
1.8	0.500	0.375	6	3	17.91	89.41	177.39	2.0	0.625	0.375	7	3	13.25	66.20	129.93
1.8	0.500	0.375	7	3	17.09	79.67	158.97	2.0	0.625	0.375	8	3	12.63	58.40	114.94
1.8	0.500	0.375	6	4	19.02	88.12	174.86	2.0	0.625	0.375	5	4	15.49	85.53	166.79
1.8	0.500	0.375	7	4	18.18	78.82	157.04	2.0	0.625	0.375	6	4	14.46	71.78	140.51
1.8	0.500	0.500	5	3	14.52	53.15	110.96	2.0	0.625	0.375	7	4	13.67	65.45	128.38
1.8	0.500	0.625	5	3	13.94	28.16	66.84	2.0	0.625	0.375	8	4	13.05	57.83	113.80
1.8	0.500	0.750	5	3	14.57	16.12	47.09	2.0	0.625	0.500	5	3	10.93	46.57	93.23
1.8	0.625	0.375	5	3	15.54	90.96	177.56	2.0	0.625	0.500	6	3	10.29	37.45	75.96
1.8	0.625	0.375	6	3	14.54	76.01	148.85	2.0	0.750	0.375	5	3	12.66	68.06	132.20
1.8	0.625	0.375	7	3	13.78	69.37	136.23	2.0	0.750	0.375	6	3	11.87	58.85	114.51
1.8	0.625	0.375	5	4	16.00	89.26	174.14	2.0	0.750	0.375	7	3	11.23	54.91	107.02
1.8	0.625	0.375	6	4	15.00	74.63	146.15	2.0	0.750	0.375	8	3	10.71	49.37	96.38

PLATE AREA - 250.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
2.0	0.750	0.375	5	4	12.82	67.08	130.24
2.0	0.750	0.375	6	4	12.04	58.05	112.96
2.0	0.750	0.375	7	4	11.41	54.27	105.74
2.0	0.750	0.375	8	4	10.89	48.85	95.35
2.0	0.875	0.375	5	3	10.64	52.27	101.28
2.0	0.875	0.375	6	3	10.09	46.38	89.98
2.0	0.875	0.375	5	4	10.70	51.60	99.97
2.0	0.875	0.375	6	4	10.15	45.81	88.88
4.0	0.500	0.375	7	3	11.03	50.10	99.00
4.0	0.500	0.375	8	3	10.44	44.02	87.47

PLATE AREA - 300.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.0	0.500	0.500	4	4	20.80	65.23	133.18	1.2	0.625	0.375	6	4	18.46	100.77	197.13	1.2	0.625	0.375	6
1.0	0.500	0.625	4	4	18.32	34.56	77.63	1.2	0.625	0.375	6	5	17.29	97.79	191.27	1.2	0.625	0.375	6
1.0	0.500	0.750	4	4	16.81	19.87	53.11	1.2	0.625	0.500	4	4	16.77	64.30	128.17	1.2	0.625	0.500	4
1.0	0.625	0.375	6	4	17.26	100.93	196.63	1.2	0.625	0.500	5	4	15.08	63.01	125.83	1.2	0.625	0.500	5
1.0	0.625	0.375	4	6	16.76	100.93	196.63	1.2	0.625	0.625	4	4	14.28	36.38	76.55	1.2	0.625	0.625	4
1.0	0.625	0.375	6	6	15.10	87.86	171.76	1.2	0.625	0.625	5	4	12.99	35.02	74.26	1.2	0.625	0.625	5
1.0	0.625	0.500	4	4	15.20	59.63	118.52	1.2	0.625	0.750	4	4	12.81	21.96	51.10	1.2	0.625	0.750	4
1.0	0.625	0.625	4	4	12.91	33.32	69.60	1.2	0.625	0.750	5	4	11.89	20.82	49.55	1.2	0.625	0.750	5
1.0	0.625	0.750	4	4	11.54	19.87	45.67	1.2	0.750	0.375	4	4	16.94	94.62	183.90	1.2	0.750	0.375	4
1.0	0.750	0.375	4	4	15.43	89.23	173.37	1.2	0.750	0.375	5	4	15.66	97.37	189.26	1.2	0.750	0.375	5
1.0	0.750	0.375	5	4	14.46	91.95	178.74	1.2	0.750	0.375	6	4	15.01	83.64	162.86	1.2	0.750	0.375	6
1.0	0.750	0.375	6	4	13.99	80.78	156.91	1.2	0.750	0.375	4	5	15.96	90.64	176.11	1.2	0.750	0.375	4
1.0	0.750	0.375	4	5	14.29	91.95	178.74	1.2	0.750	0.375	5	5	14.83	93.79	182.33	1.2	0.750	0.375	5
1.0	0.750	0.375	5	5	13.46	87.58	170.26	1.2	0.750	0.375	6	5	14.24	81.08	157.85	1.2	0.750	0.375	6
1.0	0.750	0.375	6	5	13.04	84.36	163.99	1.2	0.750	0.500	4	4	13.33	56.29	110.71	1.2	0.750	0.500	4
1.0	0.750	0.375	4	6	13.66	80.78	156.91	1.2	0.750	0.500	5	4	12.12	55.74	109.75	1.2	0.750	0.500	5
1.0	0.750	0.375	5	6	12.88	84.36	163.99	1.2	0.750	0.625	4	4	11.06	33.78	68.52	1.2	0.750	0.625	4
1.0	0.750	0.375	6	6	12.49	73.35	142.78	1.2	0.750	0.625	5	4	10.10	32.62	66.49	1.2	0.750	0.625	5
1.0	0.750	0.500	4	4	12.11	52.55	103.19	1.2	0.875	0.375	4	4	13.82	73.15	141.91	1.2	0.875	0.375	4
1.0	0.750	0.625	4	4	10.01	31.16	62.96	1.2	0.875	0.375	5	4	13.00	76.58	148.60	1.2	0.875	0.375	5
1.0	0.875	0.375	4	4	12.61	69.23	134.30	1.2	0.875	0.375	6	4	12.51	67.50	131.11	1.2	0.875	0.375	6
1.0	0.875	0.375	5	4	11.98	72.63	140.95	1.2	0.875	0.375	4	5	13.18	70.56	136.86	1.2	0.875	0.375	4
1.0	0.875	0.375	6	4	11.62	64.20	124.71	1.2	0.875	0.375	5	5	12.44	74.13	143.84	1.2	0.875	0.375	5
1.0	0.875	0.375	4	5	11.87	72.63	140.95	1.2	0.875	0.375	6	5	11.99	65.61	127.43	1.2	0.875	0.375	6
1.0	0.875	0.375	5	5	11.31	69.67	135.20	1.2	0.875	0.500	4	4	11.09	47.93	93.62	1.2	0.875	0.500	4
1.0	0.875	0.375	6	5	10.99	67.33	130.65	1.2	0.875	0.500	5	4	10.19	48.14	94.09	1.2	0.875	0.500	5
1.0	0.875	0.375	4	6	11.41	64.20	124.71	1.2	1.000	0.375	4	4	11.42	56.19	108.90	1.2	1.000	0.375	4
1.0	0.875	0.375	5	6	10.89	67.33	130.65	1.2	1.000	0.375	5	4	10.88	59.68	115.68	1.2	1.000	0.375	5
1.0	0.875	0.375	6	6	10.59	59.87	116.28	1.2	1.000	0.375	6	4	10.54	53.66	104.09	1.2	1.000	0.375	6
1.0	0.875	0.500	4	4	10.08	44.98	87.78	1.2	1.000	0.375	4	5	11.00	54.57	105.76	1.2	1.000	0.375	4
1.0	1.000	0.375	4	4	10.43	53.32	103.34	1.2	1.000	0.375	5	5	10.51	58.09	112.60	1.2	1.000	0.375	5
1.0	1.000	0.375	5	4	10.02	56.76	110.04	1.2	1.000	0.375	6	5	10.19	52.37	101.58	1.2	1.000	0.375	6
1.2	0.500	0.500	4	4	22.95	70.89	145.60	1.4	0.500	0.500	5	4	20.68	71.32	147.11	1.4	0.500	0.500	5
1.2	0.500	0.500	5	4	20.45	69.22	142.63	1.4	0.500	0.625	5	4	18.57	37.96	87.77	1.4	0.500	0.625	5
1.2	0.500	0.625	4	4	20.28	38.03	86.59	1.4	0.500	0.750	5	4	18.68	21.80	61.74	1.4	0.500	0.750	5
1.2	0.500	0.625	5	4	18.41	36.68	84.68	1.4	0.625	0.375	7	4	18.00	95.11	186.39	1.4	0.625	0.375	7
1.2	0.500	0.750	4	4	18.69	22.09	60.32	1.4	0.625	0.375	6	5	17.85	100.15	195.89	1.4	0.625	0.375	6
1.2	0.500	0.750	5	4	18.19	20.99	59.53	1.4	0.625	0.375	7	5	17.17	92.53	181.41	1.4	0.625	0.375	7

PLATE AREA - 300.0000

MAXIMUM STRESSES								MAXIMUM STRESSES							
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.4	0.625	0.500	5	4	15.35	64.67	129.18	1.6	0.750	0.375	5	4	16.14	96.34	187.18
1.4	0.625	0.625	5	4	13.15	36.19	76.75	1.6	0.750	0.375	6	4	15.26	82.83	161.21
1.4	0.625	0.750	5	4	12.01	21.61	51.36	1.6	0.750	0.375	7	4	14.56	78.07	152.12
1.4	0.750	0.375	5	4	16.14	98.29	191.03	1.6	0.750	0.375	5	5	15.61	94.23	183.10
1.4	0.750	0.375	6	4	15.35	84.39	164.30	1.6	0.750	0.375	6	5	14.78	81.38	158.38
1.4	0.750	0.375	7	4	14.72	79.94	155.78	1.6	0.750	0.375	7	5	14.12	76.56	149.20
1.4	0.750	0.375	5	5	15.47	95.51	185.65	1.6	0.750	0.500	5	4	12.30	56.38	110.93
1.4	0.750	0.375	6	5	14.74	82.44	160.49	1.6	0.750	0.500	6	4	11.62	46.26	91.66
1.4	0.750	0.375	7	5	14.15	77.93	151.90	1.6	0.875	0.375	5	4	13.44	74.97	145.39
1.4	0.750	0.500	5	4	12.41	56.92	112.05	1.6	0.875	0.375	6	4	12.81	66.13	128.40
1.4	0.750	0.625	5	4	10.27	33.60	68.46	1.6	0.875	0.375	7	4	12.28	63.55	123.47
1.4	0.875	0.375	5	4	13.42	76.92	149.20	1.6	0.875	0.375	5	5	13.08	73.51	142.57
1.4	0.875	0.375	6	4	12.84	67.76	131.59	1.6	0.875	0.375	6	5	12.48	65.04	126.27
1.4	0.875	0.375	7	4	12.36	65.35	126.98	1.6	0.875	0.375	7	5	11.98	62.46	121.35
1.4	0.875	0.375	5	5	12.97	75.00	145.49	1.6	0.875	0.500	5	4	10.45	48.19	94.12
1.4	0.875	0.375	6	5	12.42	66.30	128.75	1.6	1.000	0.375	5	4	10.83	52.15	101.10
1.4	0.875	0.375	7	5	11.97	63.89	124.17	1.6	1.000	0.375	6	4	10.45	50.92	98.77
1.4	0.875	0.500	5	4	10.48	48.89	95.53	1.6	1.000	0.375	5	5	11.03	56.99	110.40
1.4	1.000	0.375	5	4	11.25	59.70	115.69	1.6	1.000	0.375	6	5	10.61	51.40	99.64
1.4	1.000	0.375	6	4	10.84	53.67	104.07	1.6	1.000	0.375	6	5	10.61	51.40	99.64
1.4	1.000	0.375	7	4	10.49	52.55	101.96	1.6	1.000	0.375	7	5	10.24	50.17	97.32
1.4	1.000	0.375	5	5	10.94	58.45	113.28	1.8	0.500	0.375	8	3	19.76	90.72	181.07
1.4	1.000	0.375	6	5	10.56	52.67	102.13	1.8	0.500	0.375	8	4	21.10	89.88	179.28
1.4	1.000	0.375	7	5	10.22	51.56	100.03	1.8	0.500	0.500	5	3	17.39	70.03	144.74
1.6	0.500	0.500	5	4	20.13	71.12	146.63	1.8	0.500	0.500	6	3	16.72	54.88	115.58
1.6	0.500	0.500	6	4	19.43	55.47	116.93	1.8	0.500	0.625	5	3	16.32	37.17	86.20
1.6	0.500	0.625	5	3	17.36	37.96	88.52	1.8	0.500	0.625	6	3	16.36	28.66	69.64
1.6	0.500	0.625	6	3	17.13	29.23	71.30	1.8	0.500	0.750	5	3	17.66	21.32	60.17
1.6	0.500	0.750	5	3	19.07	21.69	62.18	1.8	0.500	0.750	6	3	17.40	16.23	49.91
1.6	0.625	0.375	6	4	18.54	101.11	197.78	1.8	0.625	0.375	6	3	17.45	100.01	195.56
1.6	0.625	0.375	7	4	17.68	93.30	182.82	1.8	0.625	0.375	7	3	16.53	91.31	178.99
1.6	0.625	0.375	6	5	17.83	99.51	194.61	1.8	0.625	0.375	8	3	15.81	80.41	157.98
1.6	0.625	0.375	7	5	17.03	91.36	179.08	1.8	0.625	0.375	5	4	18.02	98.21	192.06
1.6	0.625	0.500	5	4	15.09	64.33	128.42	1.8	0.625	0.375	7	4	17.11	90.07	176.43
1.6	0.625	0.500	6	4	14.37	51.43	103.89	1.8	0.625	0.375	8	4	16.38	79.36	155.90
1.6	0.625	0.625	5	3	11.71	36.50	77.74	1.8	0.625	0.500	5	3	13.67	63.66	127.21
1.6	0.625	0.625	6	3	11.32	28.61	62.48	1.8	0.625	0.500	6	3	12.92	51.06	103.05
1.6	0.625	0.750	5	3	11.56	21.69	51.87	1.8	0.625	0.625	5	3	11.18	35.65	75.64

PLATE AREA - 300.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.8	0.625	0.625	6	3	10.76	27.96	60.92	2.0	0.625	0.375	6	3	16.85	95.68	187.03	2.0	0.625	0.375	6
1.8	0.625	0.750	5	3	10.64	21.26	50.36	2.0	0.625	0.375	7	3	15.90	87.11	170.68	2.0	0.625	0.375	8
1.8	0.625	0.750	6	3	10.74	16.46	41.06	2.0	0.625	0.375	8	3	15.16	76.84	150.92	2.0	0.625	0.375	6
1.8	0.750	0.375	5	3	15.63	94.44	183.47	2.0	0.625	0.375	6	4	17.37	94.44	184.62	2.0	0.625	0.375	7
1.8	0.750	0.375	6	3	14.69	81.39	158.36	2.0	0.625	0.375	7	4	16.43	86.14	168.69	2.0	0.625	0.375	8
1.8	0.750	0.375	7	3	13.94	76.12	148.32	2.0	0.625	0.375	8	4	15.68	76.11	149.46	2.0	0.625	0.375	5
1.8	0.750	0.375	8	3	13.33	68.31	133.28	2.0	0.625	0.500	5	3	13.11	61.29	122.31	2.0	0.625	0.500	6
1.8	0.750	0.375	5	4	15.85	92.73	180.09	2.0	0.625	0.500	6	3	12.33	49.26	99.33	2.0	0.625	0.500	5
1.8	0.750	0.375	6	4	14.93	79.93	155.53	2.0	0.625	0.500	5	3	10.58	34.50	72.91	2.0	0.625	0.500	6
1.8	0.750	0.375	7	4	14.19	75.03	146.14	2.0	0.625	0.500	6	3	10.14	27.13	58.89	2.0	0.625	0.500	5
1.8	0.750	0.375	8	4	13.57	67.36	131.42	2.0	0.750	0.375	5	3	15.19	89.55	173.90	2.0	0.750	0.375	6
1.8	0.750	0.500	5	3	11.55	55.83	109.89	2.0	0.750	0.375	6	3	14.24	77.40	150.55	2.0	0.750	0.375	7
1.8	0.750	0.500	6	3	10.82	45.92	90.91	2.0	0.750	0.375	7	3	13.48	72.24	140.71	2.0	0.750	0.375	8
1.8	0.875	0.375	5	3	13.14	72.90	141.35	2.0	0.750	0.375	8	3	12.85	64.95	126.68	2.0	0.750	0.375	5
1.8	0.875	0.375	6	3	12.47	64.48	125.14	2.0	0.750	0.375	5	4	15.40	88.27	171.36	2.0	0.750	0.375	6
1.8	0.875	0.375	7	3	11.91	61.61	119.67	2.0	0.750	0.375	6	4	14.46	76.36	148.53	2.0	0.750	0.375	7
1.8	0.875	0.375	8	3	11.43	56.26	109.38	2.0	0.750	0.375	7	4	13.71	71.42	139.06	2.0	0.750	0.375	8
1.8	0.875	0.375	5	4	13.22	71.75	139.08	2.0	0.750	0.375	8	4	13.08	61.27	125.35	2.0	0.750	0.375	5
1.8	0.875	0.375	6	4	12.56	63.45	123.16	2.0	0.875	0.375	5	3	11.16	53.49	105.17	2.0	0.875	0.375	6
1.8	0.875	0.375	7	4	12.01	60.79	118.07	2.0	0.875	0.375	6	3	10.41	44.10	87.24	2.0	0.875	0.375	7
1.8	0.875	0.375	8	4	11.53	55.53	107.96	2.0	0.875	0.375	5	3	12.77	68.76	133.27	2.0	0.875	0.375	6
1.8	0.875	0.500	5	3	10.04	47.57	92.90	2.0	0.875	0.375	6	3	12.10	61.00	118.34	2.0	0.875	0.375	7
1.8	1.000	0.375	5	3	11.06	55.91	108.29	2.0	0.875	0.375	7	3	11.54	58.19	113.00	2.0	0.875	0.375	8
1.8	1.000	0.375	6	3	10.60	50.47	97.81	2.0	0.875	0.375	8	3	11.05	53.24	103.48	2.0	0.875	0.375	5
1.8	1.000	0.375	7	3	10.20	49.07	95.16	2.0	0.875	0.375	5	4	12.85	67.90	131.57	2.0	0.875	0.375	6
1.8	1.000	0.375	5	4	11.08	55.18	106.86	2.0	0.875	0.375	6	4	12.19	60.26	116.91	2.0	0.875	0.375	7
1.8	1.000	0.375	6	4	10.63	49.79	96.51	2.0	0.875	0.375	7	4	11.63	57.58	111.79	2.0	0.875	0.375	8
1.8	1.000	0.375	7	4	10.23	48.51	94.06	2.0	0.875	0.375	5	3	10.74	52.51	101.67	2.0	0.875	0.375	6
2.0	0.500	0.375	7	3	19.54	100.58	199.73	2.0	1.000	0.375	6	3	10.28	47.54	92.10	2.0	1.000	0.375	5
2.0	0.500	0.375	8	3	18.78	87.14	173.85	2.0	1.000	0.375	6	3	10.76	51.97	100.61	2.0	1.000	0.375	4
2.0	0.500	0.375	7	4	20.77	99.61	197.59	2.0	1.000	0.375	6	4	10.32	47.05	91.16	2.0	1.000	0.375	3
2.0	0.500	0.375	8	4	19.97	86.57	172.62	4.0	0.500	0.375	7	3	13.22	65.77	129.68	4.0	0.500	0.375	8
2.0	0.500	0.500	5	3	16.47	67.70	139.64	4.0	0.500	0.375	8	3	12.52	57.80	114.52	4.0	0.500	0.375	9
2.0	0.500	0.500	6	3	15.78	53.17	111.84	4.0	0.500	0.375	9	3	11.96	52.41	104.22	4.0	0.500	0.375	10
2.0	0.500	0.625	5	3	15.07	36.07	83.09	4.0	0.500	0.375	10	3	11.51	47.33	94.55	4.0	0.500	0.375	11
2.0	0.500	0.625	6	3	15.40	27.88	67.40	4.0	0.500	0.375	11	3	11.13	43.63	87.48	4.0	0.500	0.375	12
2.0	0.500	0.750	5	3	16.07	20.76	57.59	4.0	0.500	0.375	12	3	10.81	40.08	80.70	4.0	0.500	0.375	7
2.0	0.500	0.750	6	3	16.12	15.86	47.99	4.0	0.625	0.375	7	3	11.09	53.30	103.88	4.0	0.625	0.375	8
								4.0	0.625	0.375	8	3	10.48	47.87	93.52				

PLATE AREA - 350.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.0	0.500	0.500	4	4	24.50	82.28	166.91	1.0	0.875	0.375	5	5	13.21	87.92	170.62	1.0	0.875	0.375	5
1.0	0.500	0.500	5	4	22.15	80.48	164.06	1.0	0.875	0.375	6	5	12.83	84.98	164.91	1.0	0.875	0.375	6
1.0	0.500	0.500	4	5	21.73	80.48	164.06	1.0	0.875	0.375	4	6	13.33	80.99	157.29	1.0	0.875	0.375	4
1.0	0.500	0.500	5	5	19.65	77.56	158.30	1.0	0.875	0.375	5	6	12.71	84.98	164.91	1.0	0.875	0.375	5
1.0	0.500	0.625	4	4	21.65	43.63	96.39	1.0	0.875	0.375	6	6	12.36	75.56	146.71	1.0	0.875	0.375	6
1.0	0.500	0.625	5	4	19.78	42.40	95.17	1.0	0.875	0.500	4	4	11.81	56.66	110.49	1.0	0.875	0.500	4
1.0	0.500	0.625	4	5	19.43	42.40	95.17	1.0	0.875	0.500	5	4	11.01	57.09	111.47	1.0	0.875	0.500	5
1.0	0.500	0.625	5	5	17.73	41.26	92.85	1.0	0.875	0.500	4	5	10.83	57.09	111.47	1.0	0.875	0.500	4
1.0	0.500	0.750	4	4	19.88	25.12	65.07	1.0	0.875	0.500	5	5	10.15	54.19	105.84	1.0	0.875	0.500	5
1.0	0.500	0.750	5	4	18.49	24.21	65.20	1.0	1.000	0.375	4	4	12.19	67.15	130.15	1.0	1.000	0.375	4
1.0	0.500	0.750	4	5	18.18	24.21	65.20	1.0	1.000	0.375	5	4	11.70	71.61	138.84	1.0	1.000	0.375	5
1.0	0.500	0.750	5	5	17.86	23.70	64.08	1.0	1.000	0.375	6	4	11.40	64.52	125.17	1.0	1.000	0.375	6
1.0	0.625	0.500	4	4	17.87	75.16	148.93	1.0	1.000	0.375	4	5	11.62	71.61	138.84	1.0	1.000	0.375	4
1.0	0.625	0.500	5	4	16.34	73.74	146.54	1.0	1.000	0.375	5	5	11.18	69.20	134.18	1.0	1.000	0.375	5
1.0	0.625	0.500	4	5	16.01	73.74	146.54	1.0	1.000	0.375	6	5	10.90	67.22	130.32	1.0	1.000	0.375	6
1.0	0.625	0.500	5	5	14.68	70.40	139.98	1.0	1.000	0.375	4	6	11.24	64.52	125.17	1.0	1.000	0.375	4
1.0	0.625	0.625	4	4	15.23	42.02	87.01	1.0	1.000	0.375	5	6	10.83	67.22	130.32	1.0	1.000	0.375	5
1.0	0.625	0.625	5	4	14.00	40.59	84.85	1.0	1.000	0.375	6	6	10.57	60.81	117.95	1.0	1.000	0.375	6
1.0	0.625	0.625	4	5	13.71	40.59	84.85	1.0	1.000	0.500	4	4	10.04	47.50	92.36	1.0	1.000	0.500	4
1.0	0.625	0.625	5	5	12.61	39.18	82.01	1.2	0.500	0.500	5	4	23.93	87.55	178.98	1.2	0.500	0.500	5
1.0	0.625	0.750	4	4	13.64	25.06	56.61	1.2	0.500	0.625	5	4	21.54	46.49	105.13	1.2	0.500	0.625	5
1.0	0.625	0.750	5	4	12.71	23.97	55.44	1.2	0.500	0.750	5	4	20.55	26.69	72.84	1.2	0.500	0.750	5
1.0	0.625	0.750	4	5	12.45	23.97	55.44	1.2	0.625	0.500	5	4	17.64	79.64	158.43	1.2	0.625	0.500	5
1.0	0.625	0.750	5	5	11.99	23.34	54.11	1.2	0.625	0.625	5	4	15.19	44.32	92.96	1.2	0.625	0.625	5
1.0	0.750	0.375	6	4	16.34	101.79	197.67	1.2	0.625	0.750	5	4	13.90	26.39	61.44	1.2	0.625	0.750	5
1.0	0.750	0.375	4	6	15.97	101.79	197.67	1.2	0.750	0.375	7	4	16.92	100.56	195.86	1.2	0.750	0.375	7
1.0	0.750	0.375	6	6	14.59	92.61	180.17	1.2	0.750	0.375	6	5	16.62	102.33	199.11	1.2	0.750	0.375	6
1.0	0.750	0.500	4	4	14.21	66.20	129.81	1.2	0.750	0.375	7	5	16.06	97.26	189.46	1.2	0.750	0.375	7
1.0	0.750	0.500	5	4	13.11	65.71	129.07	1.2	0.750	0.375	6	6	16.10	99.58	193.76	1.2	0.750	0.375	6
1.0	0.750	0.500	4	5	12.87	65.71	129.07	1.2	0.750	0.375	7	6	15.58	94.81	184.69	1.2	0.750	0.375	7
1.0	0.750	0.500	5	5	11.94	62.40	122.61	1.2	0.750	0.375	5	4	14.17	70.42	138.39	1.2	0.750	0.375	5
1.0	0.750	0.625	4	4	11.79	39.28	78.97	1.2	0.750	0.500	5	4	11.81	41.26	83.58	1.2	0.750	0.500	5
1.0	0.750	0.625	5	4	10.91	38.02	76.92	1.2	0.750	0.625	5	4	10.48	25.38	54.72	1.2	0.750	0.625	5
1.0	0.750	0.625	4	5	10.66	38.02	76.92	1.2	0.875	0.375	5	4	15.18	96.63	187.48	1.2	0.875	0.375	5
1.0	0.750	0.750	4	4	10.30	24.28	51.38	1.2	0.875	0.375	6	4	14.61	85.14	165.34	1.2	0.875	0.375	6
1.0	0.875	0.375	4	4	14.74	87.19	169.14	1.2	0.875	0.375	7	4	14.13	82.49	160.28	1.2	0.875	0.375	7
1.0	0.875	0.375	5	4	13.99	91.66	177.86	1.2	0.875	0.375	5	5	14.52	93.54	181.50	1.2	0.875	0.375	5
1.0	0.875	0.375	6	4	13.57	80.99	157.29	1.2	0.875	0.375	6	5	13.99	82.77	160.74	1.2	0.875	0.375	6
1.0	0.875	0.375	4	5	13.87	91.66	177.86	1.2	0.875	0.375	5	5	13.99	82.77	160.74	1.2	0.875	0.375	5

PLATE AREA - 350.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.2	0.875	0.375	7	5	13.56	80.12	155.68	1.4	0.875	0.375	5	5	15.13	94.62	183.56	1.4	0.875	0.375	5
1.2	0.875	0.375	5	6	14.09	91.08	176.72	1.4	0.875	0.375	6	5	14.50	83.64	162.39	1.4	0.875	0.375	6
1.2	0.875	0.375	6	6	13.60	80.69	156.69	1.4	0.875	0.375	7	5	13.97	80.62	156.64	1.4	0.875	0.375	7
1.2	0.875	0.375	7	6	13.19	78.22	151.99	1.4	0.875	0.375	8	5	13.52	73.66	143.23	1.4	0.875	0.375	8
1.2	0.875	0.500	5	4	11.91	60.79	118.72	1.4	0.875	0.500	5	4	12.25	61.72	120.49	1.4	0.875	0.500	5
1.2	1.000	0.375	5	4	12.71	75.29	145.94	1.4	0.875	0.500	6	4	11.63	51.84	101.59	1.4	0.875	0.500	6
1.2	1.000	0.375	6	4	12.30	67.67	131.26	1.4	1.000	0.375	5	4	13.13	75.31	145.95	1.4	1.000	0.375	5
1.2	1.000	0.375	7	4	11.95	66.52	129.07	1.4	1.000	0.375	6	4	12.66	67.67	131.24	1.4	1.000	0.375	6
1.2	1.000	0.375	5	5	12.27	73.28	142.07	1.4	1.000	0.375	7	4	12.24	66.30	128.62	1.4	1.000	0.375	7
1.2	1.000	0.375	6	5	11.89	64.06	128.13	1.4	1.000	0.375	8	4	11.88	61.32	119.03	1.4	1.000	0.375	8
1.2	1.000	0.375	7	5	11.56	64.90	125.94	1.4	1.000	0.375	5	5	12.77	73.74	142.91	1.4	1.000	0.375	5
1.2	1.000	0.375	5	6	11.96	71.61	138.82	1.4	1.000	0.375	6	5	12.32	66.42	128.81	1.4	1.000	0.375	6
1.2	1.000	0.375	6	6	11.60	64.60	125.30	1.4	1.000	0.375	7	5	11.93	65.05	126.20	1.4	1.000	0.375	7
1.2	1.000	0.375	7	6	11.29	63.54	123.31	1.4	1.000	0.375	8	5	11.59	60.26	116.98	1.4	1.000	0.375	8
1.2	1.000	0.500	5	4	10.24	51.52	100.24	1.4	1.000	0.500	5	4	10.56	52.05	101.24	1.4	1.000	0.500	5
1.4	0.500	0.500	5	4	24.18	90.14	184.46	1.4	0.500	0.500	6	4	10.04	44.73	87.23	1.4	0.500	0.500	6
1.4	0.500	0.500	6	4	23.52	69.96	145.93	1.6	0.500	0.500	5	4	23.54	89.82	183.80	1.6	0.500	0.500	5
1.4	0.500	0.625	5	4	21.72	48.05	108.90	1.6	0.500	0.500	6	4	22.72	70.05	146.17	1.6	0.500	0.500	6
1.4	0.500	0.625	6	4	21.36	36.57	87.06	1.6	0.500	0.625	5	4	20.97	48.00	108.64	1.6	0.500	0.625	5
1.4	0.500	0.750	5	4	21.27	27.67	75.60	1.6	0.500	0.625	6	4	20.51	36.74	87.44	1.6	0.500	0.625	6
1.4	0.625	0.500	5	4	17.94	81.69	162.55	1.6	0.500	0.750	5	4	20.70	27.69	75.21	1.6	0.500	0.750	5
1.4	0.625	0.500	6	4	17.22	65.10	130.86	1.6	0.500	0.750	6	4	21.16	20.86	62.42	1.6	0.500	0.750	6
1.4	0.625	0.625	5	4	15.37	45.75	96.01	1.6	0.625	0.375	8	5	19.13	101.92	199.92	1.6	0.625	0.375	8
1.4	0.625	0.625	6	4	14.95	35.55	76.67	1.6	0.625	0.500	5	4	17.64	81.21	161.54	1.6	0.625	0.500	5
1.4	0.625	0.750	5	4	14.04	27.36	63.69	1.6	0.625	0.500	6	4	16.79	64.91	130.46	1.6	0.625	0.500	6
1.4	0.750	0.375	7	4	17.19	100.89	196.49	1.6	0.625	0.625	5	4	14.96	45.67	95.75	1.6	0.625	0.625	5
1.4	0.750	0.375	8	4	16.58	90.33	176.16	1.6	0.625	0.625	6	4	14.45	35.64	76.82	1.6	0.625	0.625	6
1.4	0.750	0.375	7	5	16.52	98.35	191.58	1.6	0.625	0.750	5	4	13.56	27.38	63.49	1.6	0.625	0.750	5
1.4	0.750	0.375	8	5	15.95	88.42	172.44	1.6	0.625	0.750	6	4	13.25	21.03	51.63	1.6	0.625	0.750	6
1.4	0.750	0.500	5	4	14.50	71.87	141.22	1.6	0.750	0.375	7	4	17.00	98.52	191.83	1.6	0.750	0.375	7
1.4	0.750	0.500	6	4	13.80	58.84	116.31	1.6	0.750	0.375	8	4	16.32	88.29	172.15	1.6	0.750	0.375	8
1.4	0.750	0.625	5	4	12.01	42.46	86.00	1.6	0.750	0.375	6	4	17.25	102.66	199.71	1.6	0.750	0.375	6
1.4	0.750	0.625	6	4	11.56	33.71	69.41	1.6	0.750	0.375	7	5	16.48	96.60	188.14	1.6	0.750	0.375	7
1.4	0.750	0.750	5	4	10.62	26.27	56.60	1.6	0.750	0.375	8	5	15.84	86.88	169.40	1.6	0.750	0.375	8
1.4	0.875	0.375	5	4	15.67	97.03	188.23	1.6	0.750	0.500	5	4	14.38	71.16	139.77	1.6	0.750	0.500	5
1.4	0.875	0.375	6	4	14.99	85.46	165.94	1.6	0.750	0.500	6	4	13.58	58.37	115.34	1.6	0.750	0.500	6
1.4	0.875	0.375	7	4	14.43	82.45	160.19	1.6	0.750	0.625	5	4	11.79	42.31	85.60	1.6	0.750	0.625	5
1.4	0.875	0.375	8	4	13.94	75.14	146.10	1.6	0.750	0.625	6	4	11.25	33.68	69.30	1.6	0.750	0.625	6

PLATE AREA - 350.0000

MAXIMUM STRESSES								MAXIMUM STRESSES							
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	0.750	0.750	5	4	10.33	26.28	56.44	1.8	0.750	0.375	7	5	16.16	93.22	181.50
1.6	0.875	0.375	5	4	15.69	94.57	183.40	1.8	0.750	0.375	8	5	15.47	83.95	163.65
1.6	0.875	0.375	6	4	14.96	83.40	161.90	1.8	0.750	0.500	5	4	14.01	69.19	135.80
1.6	0.875	0.375	7	4	14.34	80.18	155.73	1.8	0.750	0.500	6	4	13.14	56.91	112.41
1.6	0.875	0.375	8	4	13.81	73.12	142.14	1.8	0.750	0.625	5	4	11.35	41.37	83.56
1.6	0.875	0.375	5	5	15.27	92.73	179.85	1.8	0.750	0.625	6	4	10.76	33.05	67.91
1.6	0.875	0.375	6	5	14.57	82.04	159.25	1.8	0.875	0.375	5	4	15.43	90.49	175.43
1.6	0.875	0.375	7	5	13.98	78.79	153.06	1.8	0.875	0.375	6	4	14.66	80.01	155.29
1.6	0.875	0.375	8	5	13.47	72.02	140.01	1.8	0.875	0.375	7	4	14.02	76.68	148.90
1.6	0.875	0.500	5	4	12.21	60.82	118.68	1.8	0.875	0.375	8	4	13.47	70.04	136.13
1.6	0.875	0.500	6	4	11.51	51.15	100.20	1.8	0.875	0.375	5	5	15.10	89.11	172.78
1.6	1.000	0.375	5	4	13.15	73.07	141.57	1.8	0.875	0.375	6	5	14.36	79.01	153.33
1.6	1.000	0.375	6	4	12.64	65.75	127.49	1.8	0.875	0.375	7	5	13.74	75.65	146.90
1.6	1.000	0.375	7	4	12.20	64.24	124.59	1.8	0.875	0.375	8	5	13.21	69.24	134.56
1.6	1.000	0.375	8	4	11.80	59.45	115.38	1.8	0.875	0.500	5	4	11.96	58.85	114.77
1.6	1.000	0.375	5	5	12.87	71.88	139.27	1.8	0.875	0.500	6	4	11.22	49.63	97.17
1.6	1.000	0.375	6	5	12.38	64.82	125.66	1.8	1.000	0.375	5	4	12.93	69.59	134.79
1.6	1.000	0.375	7	5	11.95	63.29	122.76	1.8	1.000	0.375	6	4	12.41	62.78	121.70
1.6	1.000	0.375	8	5	11.57	58.67	113.86	1.8	1.000	0.375	7	4	11.95	61.19	118.65
1.6	1.000	0.375	5	4	10.56	51.04	99.24	1.8	1.000	0.375	8	4	11.54	56.72	110.04
1.8	0.500	0.500	5	4	22.45	87.86	179.63	1.8	1.000	0.375	5	5	12.71	68.70	133.07
1.8	0.500	0.500	6	4	21.53	68.85	143.60	1.8	1.000	0.375	6	5	12.20	62.09	120.35
1.8	0.500	0.625	5	4	19.79	47.04	106.14	1.8	1.000	0.375	7	5	11.75	60.48	117.28
1.8	0.500	0.625	6	4	19.27	36.20	85.98	1.8	1.000	0.375	8	5	11.36	56.14	108.92
1.8	0.500	0.750	5	3	20.48	27.01	73.92	1.8	1.000	0.500	5	4	10.38	49.16	95.51
1.8	0.500	0.750	6	3	20.18	20.57	60.98	2.0	0.500	0.375	9	4	22.61	98.45	196.27
1.8	0.625	0.375	8	4	19.13	100.13	196.37	2.0	0.500	0.375	9	5	21.89	97.01	193.54
1.8	0.625	0.375	5	5	18.57	98.97	194.10	2.0	0.500	0.500	6	3	18.40	67.10	139.80
1.8	0.625	0.500	5	4	17.03	79.26	157.54	2.0	0.500	0.500	7	3	17.79	58.19	123.11
1.8	0.625	0.500	6	4	16.10	63.58	127.72	2.0	0.500	0.625	6	3	17.53	35.23	83.34
1.8	0.625	0.625	5	4	14.27	44.74	93.58	2.0	0.500	0.625	7	3	18.27	30.05	73.93
1.8	0.625	0.625	6	4	13.69	35.06	75.45	2.0	0.500	0.750	6	3	18.86	20.07	58.81
1.8	0.625	0.750	5	3	12.33	26.87	62.53	2.0	0.500	0.750	7	3	19.39	16.83	53.11
1.8	0.625	0.750	6	3	12.43	20.79	50.75	2.0	0.625	0.375	8	4	18.31	96.01	188.23
1.8	0.750	0.375	6	4	17.43	100.81	196.07	2.0	0.625	0.375	9	4	17.60	88.10	173.02
1.8	0.750	0.375	7	4	16.56	94.65	184.26	2.0	0.625	0.375	8	5	17.86	95.17	186.59
1.8	0.750	0.375	8	4	15.85	84.98	165.65	2.0	0.625	0.375	9	5	17.17	87.05	171.01
1.8	0.750	0.375	5	5	16.98	99.48	193.48	2.0	0.625	0.500	6	3	14.38	62.13	124.70

PLATE AREA - 350.0000

MAXIMUM STRESSES								MAXIMUM STRESSES							
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
2.0	0.625	0.500	7	3	13.71	54.79	110.85	4.0	0.500	0.375	13	3	12.29	47.07	94.71
2.0	0.625	0.625	6	3	11.81	34.22	73.44	4.0	0.625	0.375	8	3	12.22	60.29	117.70
2.0	0.625	0.625	7	3	11.43	29.61	64.93	4.0	0.625	0.375	9	3	11.64	55.76	109.04
2.0	0.625	0.750	6	3	11.57	20.23	49.03	4.0	0.625	0.375	10	3	11.16	51.08	100.10
2.0	0.625	0.750	7	3	12.06	17.24	43.66	4.0	0.625	0.375	11	3	10.74	47.73	93.68
2.0	0.750	0.375	6	4	16.88	96.29	187.23	4.0	0.625	0.375	12	3	10.38	44.30	87.13
2.0	0.750	0.375	7	4	16.00	90.08	175.31	4.0	0.625	0.375	13	3	10.06	41.72	82.21
2.0	0.750	0.375	8	4	15.28	81.06	157.98	4.0	0.750	0.375	8	3	10.41	47.87	92.94
2.0	0.750	0.375	9	4	14.66	75.70	147.68								
2.0	0.750	0.375	6	5	16.53	95.33	185.36								
2.0	0.750	0.375	7	5	15.68	88.99	173.22								
2.0	0.750	0.375	8	5	14.98	80.31	156.52								
2.0	0.750	0.375	9	5	14.38	74.89	146.12								
2.0	0.750	0.500	6	3	12.14	55.60	109.73								
2.0	0.750	0.500	7	3	11.48	49.94	99.02								
2.0	0.875	0.375	6	4	14.23	75.98	147.41								
2.0	0.875	0.375	7	4	13.58	72.62	140.98								
2.0	0.875	0.375	8	4	13.02	66.48	129.17								
2.0	0.875	0.375	9	4	12.54	63.09	122.66								
2.0	0.875	0.375	6	5	13.99	75.24	145.98								
2.0	0.875	0.375	7	5	13.36	71.85	139.48								
2.0	0.875	0.375	8	5	12.82	65.89	128.02								
2.0	0.875	0.375	9	5	12.34	62.49	121.50								
2.0	0.875	0.500	6	3	10.59	48.33	94.57								
2.0	1.000	0.375	6	4	12.04	59.32	114.95								
2.0	1.000	0.375	7	4	11.58	57.70	111.85								
2.0	1.000	0.375	8	4	11.17	53.60	103.95								
2.0	1.000	0.375	9	4	10.81	51.57	100.06								
2.0	1.000	0.375	6	5	11.88	58.82	113.97								
2.0	1.000	0.375	7	5	11.43	57.17	110.83								
2.0	1.000	0.375	8	5	11.03	53.17	103.13								
2.0	1.000	0.375	9	5	10.68	51.14	99.24								
4.0	0.500	0.375	8	3	14.60	72.78	143.87								
4.0	0.500	0.375	9	3	13.95	65.99	130.87								
4.0	0.500	0.375	10	3	13.42	59.61	118.68								
4.0	0.500	0.375	11	3	12.98	54.94	109.75								
4.0	0.500	0.375	12	3	12.61	50.47	101.21								

PLATE AREA - 400.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.0	0.500	0.500	5	5	22.44	95.10	192.94	1.2	0.500	0.625	6	4	24.44	43.14	100.26	1.2	0.500	0.625	6
1.0	0.500	0.625	5	5	20.23	50.69	112.24	1.2	0.500	0.625	5	5	22.85	55.93	124.79	1.2	0.500	0.625	5
1.0	0.500	0.750	4	4	23.00	30.78	77.69	1.2	0.500	0.625	6	5	22.46	43.06	99.71	1.2	0.500	0.625	6
1.0	0.500	0.750	5	4	21.22	29.87	77.88	1.2	0.500	0.750	5	4	23.29	32.86	86.85	1.2	0.500	0.750	5
1.0	0.500	0.750	4	5	20.88	29.87	77.88	1.2	0.500	0.750	5	5	22.86	32.33	85.88	1.2	0.500	0.750	5
1.0	0.500	0.750	5	5	19.69	29.20	76.49	1.2	0.625	0.500	5	4	20.20	97.54	193.48	1.2	0.625	0.500	5
1.0	0.625	0.500	5	5	16.78	86.27	171.03	1.2	0.625	0.500	6	4	19.58	77.54	195.16	1.2	0.625	0.500	6
1.0	0.625	0.625	5	5	14.40	48.07	99.78	1.2	0.625	0.500	5	5	18.70	94.30	187.17	1.2	0.625	0.500	5
1.0	0.625	0.750	4	4	15.77	30.65	68.25	1.2	0.625	0.500	6	5	18.08	76.04	152.04	1.2	0.625	0.500	6
1.0	0.625	0.750	5	4	14.59	29.49	66.97	1.2	0.625	0.625	5	4	17.40	54.34	113.01	1.2	0.625	0.625	5
1.0	0.625	0.750	4	5	14.30	29.49	66.97	1.2	0.625	0.625	6	4	17.07	42.03	89.53	1.2	0.625	0.625	6
1.0	0.625	0.750	5	5	13.22	28.70	65.32	1.2	0.625	0.625	5	5	16.16	52.97	110.33	1.2	0.625	0.625	5
1.0	0.750	0.500	5	5	13.65	76.43	149.95	1.2	0.625	0.625	6	5	15.77	41.61	88.46	1.2	0.625	0.625	6
1.0	0.750	0.625	5	5	11.30	44.64	89.92	1.2	0.625	0.750	5	4	15.92	32.41	74.10	1.2	0.625	0.750	5
1.0	0.750	0.750	4	4	11.89	29.68	62.28	1.2	0.625	0.750	5	5	14.92	31.79	72.88	1.2	0.625	0.750	5
1.0	0.750	0.750	5	4	11.04	28.44	60.46	1.2	0.750	0.500	5	4	16.22	86.22	169.18	1.2	0.750	0.500	5
1.0	0.750	0.750	4	5	10.80	28.44	60.46	1.2	0.750	0.500	6	5	15.59	70.54	139.12	1.2	0.750	0.500	6
1.0	0.875	0.375	7	5	10.03	27.48	58.49	1.2	0.750	0.500	5	5	15.13	82.98	162.88	1.2	0.750	0.500	5
1.0	0.875	0.375	6	6	14.13	92.42	179.44	1.2	0.750	0.625	5	4	13.53	50.56	101.93	1.2	0.750	0.625	5
1.0	0.875	0.375	7	6	13.80	90.05	174.95	1.2	0.750	0.625	6	4	13.14	40.04	81.90	1.2	0.750	0.625	6
1.0	0.875	0.375	5	7	14.05	100.89	193.76	1.2	0.750	0.625	5	5	12.61	48.99	98.85	1.2	0.750	0.625	5
1.0	0.875	0.375	6	7	13.68	90.05	174.95	1.2	0.750	0.625	6	5	12.22	39.29	80.26	1.2	0.750	0.625	6
1.0	0.875	0.375	7	7	13.37	87.61	170.19	1.2	0.750	0.750	5	4	12.01	31.13	66.40	1.2	0.750	0.750	5
1.0	0.875	0.500	5	5	11.60	66.36	129.49	1.2	0.750	0.750	5	5	11.26	30.39	64.92	1.2	0.750	0.750	5
1.0	1.000	0.375	5	5	12.78	84.64	164.11	1.2	0.875	0.375	7	4	16.16	100.91	196.03	1.2	0.875	0.375	7
1.0	1.000	0.375	6	5	12.47	82.22	159.41	1.2	0.875	0.375	6	5	16.00	101.23	196.54	1.2	0.875	0.375	6
1.0	1.000	0.375	7	5	12.19	80.07	155.24	1.2	0.875	0.375	7	5	15.50	98.01	190.41	1.2	0.875	0.375	7
1.0	1.000	0.375	5	6	12.38	82.22	159.41	1.2	0.875	0.375	6	6	15.55	98.69	191.61	1.2	0.875	0.375	6
1.0	1.000	0.375	6	6	12.08	74.36	144.24	1.2	0.875	0.375	7	6	15.08	95.70	185.91	1.2	0.875	0.375	7
1.0	1.000	0.375	7	6	11.83	73.46	142.55	1.2	0.875	0.500	5	4	13.64	74.41	145.20	1.2	0.875	0.500	5
1.0	1.000	0.375	5	7	12.02	80.07	155.24	1.2	0.875	0.500	6	4	13.06	62.51	122.37	1.2	0.875	0.500	6
1.0	1.000	0.375	6	7	11.75	73.46	142.55	1.2	0.875	0.500	5	5	12.82	71.54	139.63	1.2	0.875	0.500	5
1.0	1.000	0.375	7	7	11.50	71.67	139.08	1.2	0.875	0.500	6	5	12.30	60.58	118.56	1.2	0.875	0.500	6
1.0	1.000	0.500	5	5	10.08	56.67	110.25	1.2	0.875	0.625	5	4	11.18	46.15	91.56	1.2	0.875	0.625	5
1.2	0.500	0.500	6	4	26.89	82.84	171.13	1.2	0.875	0.625	6	4	10.78	37.41	74.92	1.2	0.875	0.625	6
1.2	0.500	0.500	6	5	24.53	82.17	169.48	1.2	0.875	0.625	5	5	10.46	44.50	88.33	1.2	0.875	0.625	5
1.2	0.500	0.625	5	4	24.68	57.07	126.96	1.2	1.000	0.625	6	5	10.09	36.44	72.92	1.2	1.000	0.625	6
													14.53	92.06	178.47				

PLATE AREA - 400.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.2	1.000	0.375	6	4	14.07	82.73	160.47	1.4	0.875	0.500	6	4	13.30	63.40	124.11	1.4	0.875	0.500	6
1.2	1.000	0.375	7	4	13.67	81.35	157.85	1.4	0.875	0.625	5	4	11.42	47.26	93.74	1.4	0.875	0.625	5
1.2	1.000	0.375	5	5	14.02	89.62	173.74	1.4	0.875	0.625	6	4	10.90	38.33	76.75	1.4	0.875	0.625	6
1.2	1.000	0.375	6	5	13.59	80.77	156.66	1.4	1.000	0.375	5	4	15.01	92.08	178.47	1.4	1.000	0.375	5
1.2	1.000	0.375	7	5	13.22	79.38	154.03	1.4	1.000	0.375	6	4	14.47	82.73	160.44	1.4	1.000	0.375	6
1.2	1.000	0.375	5	6	13.68	87.58	169.79	1.4	1.000	0.375	7	4	14.00	81.08	157.29	1.4	1.000	0.375	7
1.2	1.000	0.375	6	6	13.27	79.00	153.22	1.4	1.000	0.375	8	4	13.58	74.98	145.53	1.4	1.000	0.375	8
1.2	1.000	0.375	7	6	12.91	77.73	150.82	1.4	1.000	0.375	5	5	14.60	90.16	174.77	1.4	1.000	0.375	5
1.2	1.000	0.500	5	4	11.72	63.04	122.62	1.4	1.000	0.375	6	5	14.09	81.21	157.49	1.4	1.000	0.375	6
1.2	1.000	0.500	6	4	11.23	54.20	105.65	1.4	1.000	0.375	7	5	13.64	79.55	154.33	1.4	1.000	0.375	7
1.2	1.000	0.500	5	5	11.11	60.72	118.12	1.4	1.000	0.375	8	5	13.25	73.70	143.04	1.4	1.000	0.375	8
1.2	1.000	0.500	6	5	10.67	52.51	102.35	1.4	1.000	0.375	5	6	14.32	88.56	171.66	1.4	1.000	0.375	5
								1.4	1.000	0.375	6	6	13.83	79.82	154.80	1.4	1.000	0.375	6
1.4	0.500	0.500	6	4	26.93	85.67	177.24	1.4	1.000	0.375	7	6	13.40	78.26	151.84	1.4	1.000	0.375	7
1.4	0.500	0.625	5	4	24.87	58.93	131.42	1.4	1.000	0.375	8	6	13.02	72.56	140.83	1.4	1.000	0.375	8
1.4	0.500	0.625	6	4	24.47	44.83	104.60	1.4	1.000	0.500	5	4	12.08	63.67	123.82	1.4	1.000	0.500	5
1.4	0.500	0.750	5	4	23.64	34.02	90.16	1.4	1.000	0.500	6	4	11.49	54.70	106.61	1.4	1.000	0.500	6
1.4	0.625	0.500	5	4	23.89	25.48	73.81	1.6	0.500	0.500	6	4	26.01	85.76	177.50	1.6	0.500	0.500	6
1.4	0.625	0.500	6	4	20.54	100.00	198.41	1.6	0.500	0.625	5	4	24.02	58.83	131.12	1.6	0.500	0.625	5
1.4	0.625	0.500	6	4	19.72	79.66	159.49	1.6	0.500	0.625	6	4	23.49	45.04	103.08	1.6	0.500	0.625	6
1.4	0.625	0.625	5	4	17.61	56.05	116.65	1.6	0.500	0.750	5	4	23.16	34.02	89.80	1.6	0.500	0.750	5
1.4	0.625	0.625	6	4	17.12	43.53	92.86	1.6	0.500	0.750	6	4	23.70	25.64	74.10	1.6	0.500	0.750	6
1.4	0.625	0.750	5	4	16.07	33.56	76.78	1.6	0.625	0.500	5	4	20.19	99.38	197.12	1.6	0.625	0.500	5
1.4	0.625	0.750	6	4	15.78	25.63	61.78	1.6	0.625	0.500	6	4	19.22	79.41	158.97	1.6	0.625	0.500	6
1.4	0.750	0.500	5	4	16.60	87.96	172.57	1.6	0.625	0.625	5	4	17.14	55.92	116.30	1.6	0.625	0.625	5
1.4	0.750	0.500	6	4	15.80	71.98	141.98	1.6	0.625	0.625	6	4	16.55	43.62	93.04	1.6	0.625	0.625	6
1.4	0.750	0.625	5	4	13.75	51.99	104.82	1.6	0.625	0.750	5	4	15.53	33.56	76.58	1.6	0.625	0.750	5
1.4	0.750	0.625	6	4	13.23	41.25	84.41	1.6	0.625	0.750	6	4	15.17	25.77	61.99	1.6	0.625	0.750	6
1.4	0.750	0.750	5	4	12.16	32.19	68.65	1.6	0.750	0.500	5	4	18.02	101.33	197.62	1.6	0.750	0.500	5
1.4	0.750	0.750	6	4	11.83	25.04	55.15	1.6	0.750	0.375	9	4	17.49	99.56	194.22	1.6	0.750	0.375	9
1.4	0.875	0.375	7	4	16.50	100.85	195.89	1.6	0.750	0.375	9	5	16.45	87.06	170.76	1.6	0.750	0.375	9
1.4	0.875	0.375	8	4	15.95	91.89	178.62	1.6	0.750	0.500	5	4	15.54	71.39	140.78	1.6	0.750	0.500	5
1.4	0.875	0.375	6	5	16.58	102.28	198.55	1.6	0.750	0.500	6	4	13.50	51.78	104.31	1.6	0.750	0.500	6
1.4	0.875	0.375	7	5	15.98	98.61	191.55	1.6	0.750	0.625	5	4	12.88	41.20	84.27	1.6	0.750	0.625	5
1.4	0.875	0.375	8	5	15.45	90.10	175.13	1.6	0.750	0.625	6	4	11.83	32.17	68.47	1.6	0.750	0.625	6
1.4	0.875	0.375	6	6	16.22	100.30	194.70	1.6	0.750	0.750	5	4	11.43	25.12	55.24	1.6	0.750	0.750	5
1.4	0.875	0.375	7	6	15.65	96.82	188.08	1.6	0.750	0.750	6	4	17.10	101.96	197.91	1.6	0.750	0.750	6
1.4	0.875	0.375	8	6	15.15	88.55	172.12	1.6	0.875	0.375	6	4	16.39	98.05	190.41	1.6	0.875	0.375	6
1.4	0.875	0.500	5	4	14.01	75.52	147.32	1.6	0.875	0.375	7	4				1.6	0.875	0.375	7

PLATE AREA - 400.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.6	0.875	0.375	8	4	15.79	89.41	173.76	1.8	0.750	0.750	6	4	10.83	24.73	54.23	1.8	0.750	0.750	6
1.6	0.875	0.375	9	4	15.26	85.13	165.55	1.8	0.750	0.750	7	4	10.52	21.45	47.99	1.8	0.750	0.750	7
1.6	0.875	0.375	6	5	16.65	100.31	194.69	1.8	0.875	0.375	6	4	16.77	97.81	189.82	1.8	0.875	0.375	6
1.6	0.875	0.375	7	5	15.98	96.36	187.15	1.8	0.875	0.375	7	4	16.03	93.76	182.05	1.8	0.875	0.375	7
1.6	0.875	0.375	8	5	15.40	88.07	171.17	1.8	0.875	0.375	8	4	15.40	85.64	166.40	1.8	0.875	0.375	8
1.6	0.875	0.375	9	5	14.90	83.81	162.99	1.8	0.875	0.375	9	4	14.85	81.39	158.24	1.8	0.875	0.375	9
1.6	0.875	0.500	5	4	13.97	74.40	145.08	1.8	0.875	0.375	6	5	16.41	96.60	187.44	1.8	0.875	0.375	6
1.6	0.875	0.500	6	4	13.17	62.55	122.40	1.8	0.875	0.375	7	5	15.71	92.50	179.61	1.8	0.875	0.375	7
1.6	0.875	0.625	5	4	11.29	46.93	93.00	1.8	0.875	0.375	8	5	15.10	84.66	164.50	1.8	0.875	0.375	8
1.6	0.875	0.625	6	4	10.69	38.13	76.30	1.8	0.875	0.375	9	5	14.57	80.41	156.34	1.8	0.875	0.375	9
1.6	1.000	0.375	6	4	14.46	80.38	155.85	1.8	0.875	0.500	6	4	12.83	60.68	118.69	1.8	0.875	0.500	6
1.6	1.000	0.375	7	4	13.95	78.55	152.35	1.8	0.875	0.500	7	4	12.18	55.94	109.65	1.8	0.875	0.500	7
1.6	1.000	0.375	8	4	13.50	72.69	141.06	1.8	0.875	0.625	6	4	10.32	37.27	74.52	1.8	0.875	0.625	6
1.6	1.000	0.375	9	4	13.09	70.11	136.11	1.8	1.000	0.375	6	4	14.18	76.74	148.77	1.8	1.000	0.375	6
1.6	1.000	0.375	6	5	14.15	79.24	153.64	1.8	1.000	0.375	7	4	13.66	74.81	145.07	1.8	1.000	0.375	7
1.6	1.000	0.375	7	5	13.66	77.39	150.12	1.8	1.000	0.375	8	4	13.19	69.34	134.53	1.8	1.000	0.375	8
1.6	1.000	0.375	8	5	13.23	71.74	139.21	1.8	1.000	0.375	9	4	12.78	66.79	129.63	1.8	1.000	0.375	9
1.6	1.000	0.375	9	5	12.84	69.17	134.29	1.8	1.000	0.375	6	5	13.94	75.90	147.13	1.8	1.000	0.375	6
1.6	1.000	0.500	5	4	12.08	62.43	121.36	1.8	1.000	0.375	7	5	13.44	73.95	143.40	1.8	1.000	0.375	7
1.6	1.000	0.500	6	4	11.43	53.70	104.63	1.8	1.000	0.375	8	5	12.99	68.64	133.17	1.8	1.000	0.375	8
1.8	0.500	0.500	6	4	24.66	84.26	174.38	1.8	1.000	0.375	9	5	12.58	66.09	128.28	1.8	1.000	0.375	9
1.8	0.500	0.500	7	4	23.98	73.47	153.61	1.8	1.000	0.500	6	4	11.18	51.84	100.96	1.8	1.000	0.500	6
1.8	0.500	0.625	6	4	22.07	44.37	103.37	1.8	1.000	0.500	7	4	10.62	48.63	94.83	1.8	1.000	0.500	7
1.8	0.500	0.625	7	4	21.71	37.91	90.85	2.0	0.500	0.500	6	4	23.16	81.94	169.47	2.0	0.500	0.500	6
1.8	0.500	0.750	6	4	22.79	25.31	72.68	2.0	0.500	0.500	7	4	22.45	70.53	147.41	2.0	0.500	0.500	7
1.8	0.500	0.750	7	4	22.63	21.21	64.50	2.0	0.500	0.625	6	4	20.52	43.25	100.52	2.0	0.500	0.625	6
1.8	0.625	0.500	6	4	18.43	77.76	155.62	2.0	0.500	0.625	7	4	20.14	36.38	86.98	2.0	0.500	0.625	7
1.8	0.625	0.500	7	4	17.68	69.10	139.04	2.0	0.500	0.750	6	3	21.39	24.63	70.07	2.0	0.500	0.750	6
1.8	0.625	0.625	6	4	15.68	42.90	91.39	2.0	0.500	0.750	7	3	22.03	20.69	63.13	2.0	0.500	0.750	7
1.8	0.625	0.625	7	4	15.24	37.32	80.71	2.0	0.625	0.375	10	4	19.46	97.68	191.94	2.0	0.625	0.375	10
1.8	0.625	0.750	6	4	14.26	25.41	60.88	2.0	0.625	0.375	10	5	18.98	96.80	190.23	2.0	0.625	0.375	10
1.8	0.625	0.750	7	4	14.07	21.70	53.74	2.0	0.625	0.500	6	4	17.52	75.38	150.77	2.0	0.625	0.500	6
1.8	0.750	0.375	9	4	17.44	97.25	189.64	2.0	0.625	0.500	7	4	16.74	66.38	133.48	2.0	0.625	0.500	7
1.8	0.750	0.375	9	5	17.03	95.94	187.10	2.0	0.625	0.625	6	4	14.72	41.76	88.80	2.0	0.625	0.625	6
1.8	0.750	0.500	6	4	15.04	69.59	137.19	2.0	0.625	0.625	7	4	14.26	35.88	77.47	2.0	0.625	0.625	7
1.8	0.750	0.500	7	4	14.31	63.00	124.58	2.0	0.625	0.750	6	3	13.11	24.76	58.98	2.0	0.625	0.750	6
1.8	0.750	0.625	6	4	12.32	40.42	82.58	2.0	0.625	0.750	7	3	13.67	21.13	52.43	2.0	0.625	0.750	7
1.8	0.750	0.625	7	4	11.85	35.71	73.63	2.0	0.750	0.375	8	4	17.47	99.11	193.05	2.0	0.750	0.375	8

PLATE AREA - 400.0000

MAXIMUM STRESSES															MAXIMUM STRESSES				
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL				
2.0	0.750	0.375	9	4	16.77	92.57	180.46	4.0	0.500	0.375	12	3	14.41	61.64	123.19				
2.0	0.750	0.375	10	4	16.17	84.99	165.88	4.0	0.500	0.375	13	3	14.05	57.49	115.24				
2.0	0.750	0.375	8	5	17.12	98.20	191.27	4.0	0.500	0.500	8	3	12.17	42.72	89.21				
2.0	0.750	0.375	9	5	16.44	91.57	178.55	4.0	0.500	0.500	9	3	11.79	37.92	79.99				
2.0	0.750	0.375	10	5	15.86	84.24	164.43	4.0	0.500	0.500	10	3	11.49	33.91	72.44				
2.0	0.750	0.500	6	4	14.43	67.17	132.33	4.0	0.500	0.625	8	3	10.39	22.78	53.52				
2.0	0.750	0.500	7	4	13.68	60.41	119.39	4.0	0.500	0.625	9	3	10.30	19.91	47.87				
2.0	0.750	0.625	6	4	11.69	39.24	80.07	4.0	0.500	0.625	10	3	10.60	17.73	43.91				
2.0	0.750	0.625	7	4	11.19	34.35	70.72	4.0	0.625	0.375	8	3	13.96	73.63	143.67				
2.0	0.875	0.375	6	4	16.27	92.87	180.18	4.0	0.625	0.375	9	3	13.30	68.10	133.07				
2.0	0.875	0.375	7	4	15.53	88.79	172.35	4.0	0.625	0.375	10	3	12.74	62.38	122.13				
2.0	0.875	0.375	8	4	14.89	81.28	157.89	4.0	0.625	0.375	11	3	12.27	58.28	114.28				
2.0	0.875	0.375	9	4	14.33	77.14	149.94	4.0	0.625	0.375	12	3	11.85	54.10	106.26				
2.0	0.875	0.375	10	4	13.85	71.73	139.52	4.0	0.625	0.375	13	3	11.49	50.96	100.24				
2.0	0.875	0.375	6	5	15.99	91.98	178.45	4.0	0.750	0.375	8	3	11.89	58.48	113.53				
2.0	0.875	0.375	7	5	15.27	87.84	170.52	4.0	0.750	0.375	9	3	11.38	55.10	107.06				
2.0	0.875	0.375	8	5	14.65	80.56	156.49	4.0	0.750	0.375	10	3	10.93	51.24	99.68				
2.0	0.875	0.375	9	5	14.11	76.40	148.51	4.0	0.750	0.375	11	3	10.53	48.52	94.47				
2.0	0.875	0.375	10	5	13.64	71.14	138.37	4.0	0.750	0.375	12	3	10.18	45.56	88.80				
2.0	0.875	0.500	6	4	12.39	58.27	113.93	4.0	0.875	0.375	8	3	10.10	45.37	87.86				
2.0	0.875	0.500	7	4	11.72	53.48	104.75												
2.0	1.000	0.375	6	4	13.76	72.51	140.53												
2.0	1.000	0.375	7	4	13.24	70.54	136.75												
2.0	1.000	0.375	8	4	12.78	65.52	127.08												
2.0	1.000	0.375	9	4	12.36	63.05	122.33												
2.0	1.000	0.375	10	4	11.99	59.30	115.12												
2.0	1.000	0.375	6	5	13.58	71.90	139.33												
2.0	1.000	0.375	7	5	13.07	69.90	135.51												
2.0	1.000	0.375	8	5	12.61	65.00	126.08												
2.0	1.000	0.375	9	5	12.21	62.52	121.32												
2.0	1.000	0.375	10	5	11.84	58.86	114.27												
2.0	1.000	0.500	6	4	10.83	49.54	96.43												
2.0	1.000	0.500	7	4	10.27	46.31	90.26												
4.0	0.500	0.375	8	3	16.68	88.88	175.37												
4.0	0.500	0.375	9	3	15.94	80.58	159.45												
4.0	0.500	0.375	10	3	15.33	72.79	144.55												
4.0	0.500	0.375	11	3	14.83	67.09	133.63												

PLATE AREA - 450.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.0	0.500	0.625	5	5	22.73	60.76	132.80	1.2	0.750	0.500	6	4	17.57	84.29	165.95	1.2	0.750	0.500	6
1.0	0.500	0.750	5	5	21.61	35.10	89.52	1.2	0.750	0.500	5	5	17.03	99.19	194.45	1.2	0.750	0.500	5
1.0	0.625	0.625	5	5	16.19	57.57	118.68	1.2	0.750	0.500	6	5	16.37	82.02	161.42	1.2	0.750	0.500	6
1.0	0.625	0.750	5	5	14.85	34.42	77.19	1.2	0.750	0.625	5	4	15.25	60.48	121.47	1.2	0.750	0.625	5
1.0	0.750	0.500	5	5	15.36	91.40	179.10	1.2	0.750	0.625	6	4	14.81	47.87	97.40	1.2	0.750	0.625	6
1.0	0.750	0.625	5	5	12.71	53.43	107.22	1.2	0.750	0.625	5	5	14.18	58.59	117.76	1.2	0.750	0.625	5
1.0	0.750	0.750	5	5	11.27	32.93	69.47	1.2	0.750	0.625	6	5	13.74	46.99	95.51	1.2	0.750	0.625	6
1.0	0.875	0.500	5	5	13.06	79.33	154.71	1.2	0.750	0.750	5	4	13.54	37.27	78.80	1.2	0.750	0.750	5
1.0	0.875	0.625	5	5	10.60	48.80	96.57	1.2	0.750	0.750	6	4	13.28	28.87	62.84	1.2	0.750	0.750	6
1.0	1.000	0.375	5	5	14.39	101.08	195.99	1.2	0.750	0.750	5	5	12.65	36.37	77.01	1.2	0.750	0.750	5
1.0	1.000	0.375	6	5	14.03	98.20	190.40	1.2	0.750	0.750	6	5	12.36	28.55	62.00	1.2	0.750	0.750	6
1.0	1.000	0.375	7	5	13.72	95.64	185.44	1.2	0.875	0.375	8	7	16.14	102.53	199.27	1.2	0.875	0.375	8
1.0	1.000	0.375	5	6	13.60	88.80	172.24	1.2	0.875	0.500	5	4	15.36	88.93	173.42	1.2	0.875	0.500	5
1.0	1.000	0.375	6	6	13.31	87.75	170.27	1.2	0.875	0.500	6	4	14.71	74.67	146.04	1.2	0.875	0.500	6
1.0	1.000	0.375	7	6	13.53	95.64	185.44	1.2	0.875	0.500	5	5	14.43	85.50	166.76	1.2	0.875	0.500	5
1.0	1.000	0.375	5	7	13.22	87.75	170.27	1.2	0.875	0.625	6	5	13.84	72.39	141.54	1.2	0.875	0.625	6
1.0	1.000	0.375	6	7	12.95	85.62	166.14	1.2	0.875	0.625	5	4	12.60	55.19	109.25	1.2	0.875	0.625	5
1.0	1.000	0.375	7	7	12.95	85.62	166.14	1.2	0.875	0.625	5	5	12.15	44.71	89.25	1.2	0.875	0.625	5
1.0	1.000	0.500	5	5	11.35	67.73	131.73	1.2	0.875	0.625	6	5	11.77	53.21	105.38	1.2	0.875	0.625	6
1.2	0.500	0.625	5	4	27.83	68.37	150.08	1.2	0.875	0.625	6	5	11.35	43.57	86.92	1.2	0.875	0.625	6
1.2	0.500	0.625	6	4	27.56	51.68	118.06	1.2	0.875	0.750	5	4	10.92	35.18	71.92	1.2	0.875	0.750	5
1.2	0.500	0.625	5	5	25.67	66.97	147.43	1.2	0.875	0.750	6	4	10.62	27.80	57.92	1.2	0.875	0.750	6
1.2	0.500	0.625	6	5	25.22	51.60	117.50	1.2	0.875	0.750	5	5	10.23	34.14	69.86	1.2	0.875	0.750	5
1.2	0.500	0.750	5	4	26.26	39.46	101.55	1.2	1.000	0.375	6	5	15.30	96.44	187.05	1.2	1.000	0.375	6
1.2	0.500	0.750	6	4	26.13	29.36	81.95	1.2	1.000	0.375	7	5	14.88	94.80	183.95	1.2	1.000	0.375	7
1.2	0.500	0.750	5	5	24.90	38.81	100.35	1.2	1.000	0.375	8	5	14.50	87.89	170.60	1.2	1.000	0.375	8
1.2	0.500	0.750	6	5	24.39	29.36	81.53	1.2	1.000	0.375	6	6	14.93	94.33	182.96	1.2	1.000	0.375	6
1.2	0.625	0.500	6	4	22.06	92.68	184.86	1.2	1.000	0.375	7	6	14.53	92.84	180.13	1.2	1.000	0.375	7
1.2	0.625	0.500	6	5	20.33	90.93	181.22	1.2	1.000	0.375	8	6	14.18	86.13	167.18	1.2	1.000	0.375	8
1.2	0.625	0.625	5	4	19.62	65.04	134.32	1.2	1.000	0.375	5	7	15.05	102.43	198.59	1.2	1.000	0.375	5
1.2	0.625	0.625	6	4	19.25	50.28	106.13	1.2	1.000	0.375	6	7	14.61	92.43	179.27	1.2	1.000	0.375	6
1.2	0.625	0.625	6	4	18.16	63.38	131.08	1.2	1.000	0.375	7	7	14.23	91.07	176.70	1.2	1.000	0.375	7
1.2	0.625	0.625	5	5	17.72	49.80	104.92	1.2	1.000	0.375	8	7	13.89	84.54	164.10	1.2	1.000	0.375	8
1.2	0.625	0.625	6	5	17.95	38.84	87.48	1.2	1.000	0.500	5	4	13.20	75.33	146.47	1.2	1.000	0.500	5
1.2	0.625	0.750	5	4	17.74	29.49	69.63	1.2	1.000	0.500	6	4	12.65	64.74	126.13	1.2	1.000	0.500	6
1.2	0.625	0.750	6	4	16.76	28.07	64.00	1.2	1.000	0.500	5	5	12.51	72.55	141.10	1.2	1.000	0.500	5
1.2	0.625	0.750	5	5	16.47	29.36	69.09	1.2	1.000	0.500	6	5	12.01	62.73	122.21	1.2	1.000	0.500	6
1.2	0.625	0.750	6	5	16.47	29.36	69.09	1.2	1.000	0.625	5	4	10.81	49.54	97.25	1.2	1.000	0.625	5

PLATE AREA - 450.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.2	1.000	0.625	6	4	10.37	41.03	81.01	1.4	1.000	0.375	6	5	15.85	96.96	188.04	1.4	1.000	0.375	6
1.2	1.000	0.625	5	5	10.15	47.64	93.56	1.4	1.000	0.375	7	5	15.35	95.00	184.29	1.4	1.000	0.375	7
1.4	0.500	0.625	5	4	28.03	70.55	155.27	1.4	1.000	0.375	8	5	14.91	88.01	170.80	1.4	1.000	0.375	8
1.4	0.500	0.625	6	4	27.57	53.70	123.12	1.4	1.000	0.375	6	6	15.56	93.47	184.84	1.4	1.000	0.375	6
1.4	0.500	0.625	5	5	26.40	69.54	153.50	1.4	1.000	0.375	7	6	15.08	93.47	181.33	1.4	1.000	0.375	7
1.4	0.500	0.625	6	5	25.80	53.68	122.77	1.4	1.000	0.375	8	6	14.65	86.65	168.17	1.4	1.000	0.375	8
1.4	0.500	0.750	5	4	26.45	40.81	105.41	1.4	1.000	0.500	5	4	13.60	76.06	147.87	1.4	1.000	0.500	5
1.4	0.500	0.750	6	4	26.20	30.59	85.84	1.4	1.000	0.500	6	4	12.94	65.33	127.26	1.4	1.000	0.500	6
1.4	0.625	0.500	6	4	22.21	95.20	189.97	1.4	1.000	0.500	5	5	13.05	73.91	143.70	1.4	1.000	0.500	5
1.4	0.625	0.500	6	5	20.89	93.97	187.42	1.4	1.000	0.500	6	5	12.43	63.80	124.28	1.4	1.000	0.500	6
1.4	0.625	0.625	5	4	19.84	67.03	138.57	1.4	1.000	0.625	5	4	11.09	50.48	99.07	1.4	1.000	0.625	5
1.4	0.625	0.625	6	4	19.30	52.05	110.03	1.4	1.000	0.625	6	4	10.54	41.79	82.50	1.4	1.000	0.625	6
1.4	0.625	0.625	5	5	18.74	65.82	136.28	1.4	1.000	0.625	5	5	10.58	49.03	96.25	1.4	1.000	0.625	5
1.4	0.625	0.625	6	5	18.15	51.75	109.24	1.4	1.000	0.625	6	5	10.06	40.88	80.67	1.4	1.000	0.625	6
1.4	0.625	0.750	5	4	18.11	40.17	90.61	1.6	0.500	0.500	7	4	28.60	90.77	188.32	1.6	0.500	0.500	7
1.4	0.625	0.750	6	4	17.79	30.68	72.61	1.6	0.500	0.625	6	4	26.47	53.90	123.70	1.6	0.500	0.625	6
1.4	0.750	0.500	6	4	17.80	85.99	169.33	1.6	0.500	0.625	7	4	26.10	46.98	110.50	1.6	0.500	0.625	7
1.4	0.750	0.500	6	5	16.87	84.34	156.01	1.6	0.500	0.750	6	4	26.06	30.76	86.25	1.6	0.500	0.750	6
1.4	0.750	0.625	5	4	15.49	62.16	124.85	1.6	0.500	0.750	7	4	26.24	26.38	77.88	1.6	0.500	0.750	7
1.4	0.750	0.625	6	4	14.91	49.29	100.36	1.6	0.625	0.500	6	4	21.66	94.87	189.32	1.6	0.625	0.500	6
1.4	0.750	0.625	5	5	14.69	60.75	122.14	1.6	0.625	0.500	7	4	20.88	85.23	170.89	1.6	0.625	0.500	7
1.4	0.750	0.625	6	5	14.10	48.69	99.04	1.6	0.625	0.625	6	4	18.64	52.14	110.23	1.6	0.625	0.625	6
1.4	0.750	0.625	6	4	13.70	38.51	81.43	1.6	0.625	0.625	7	4	18.19	46.04	98.64	1.6	0.625	0.625	7
1.4	0.750	0.750	5	4	13.33	29.93	65.21	1.6	0.625	0.750	6	4	17.09	30.83	72.89	1.6	0.625	0.750	6
1.4	0.750	0.750	6	4	13.78	90.23	175.91	1.6	0.625	0.750	7	4	16.82	26.82	65.32	1.6	0.625	0.750	7
1.4	0.875	0.500	6	4	14.98	75.73	148.10	1.6	0.750	0.500	6	4	17.50	85.26	167.87	1.6	0.750	0.500	6
1.4	0.875	0.500	5	5	15.05	87.58	170.79	1.6	0.750	0.500	7	4	16.74	77.80	153.59	1.6	0.750	0.500	7
1.4	0.875	0.500	6	5	14.31	74.02	144.72	1.6	0.750	0.625	6	4	14.51	49.22	100.18	1.6	0.750	0.625	6
1.4	0.875	0.625	5	4	12.87	56.49	111.80	1.6	0.750	0.625	7	4	14.02	43.99	90.25	1.6	0.750	0.625	7
1.4	0.875	0.625	6	4	12.29	45.79	91.41	1.6	0.750	0.750	6	4	12.88	30.02	65.33	1.6	0.750	0.750	6
1.4	0.875	0.625	5	5	12.23	55.00	108.91	1.6	0.750	0.750	7	4	12.57	26.42	58.56	1.6	0.750	0.750	7
1.4	0.875	0.625	6	5	11.68	44.96	89.71	1.6	0.875	0.375	9	5	17.18	101.67	197.66	1.6	0.875	0.375	9
1.4	0.875	0.750	6	5	11.10	36.25	74.09	1.6	0.875	0.375	9	6	16.77	100.10	194.61	1.6	0.875	0.375	9
1.4	0.875	0.750	6	4	10.70	28.69	59.80	1.6	0.875	0.375	9	6	16.52	98.85	192.18	1.6	0.875	0.375	9
1.4	1.000	0.375	6	4	16.29	98.76	191.54	1.6	0.875	0.500	6	4	14.83	74.70	146.05	1.6	0.875	0.500	6
1.4	1.000	0.375	7	4	15.76	96.82	187.83	1.6	0.875	0.500	7	4	14.14	69.27	135.67	1.6	0.875	0.500	7
1.4	1.000	0.375	8	4	15.29	89.53	173.76	1.6	0.875	0.625	6	4	12.05	45.54	90.87	1.6	0.875	0.625	6

PLATE AREA - 450.0000

MAXIMUM STRESSES								MAXIMUM STRESSES							
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	0.875	0.625	7	4	11.55	41.21	82.65	1.8	0.875	0.375	8	5	16.99	101.09	196.39
1.6	0.875	0.750	6	4	10.40	28.70	59.74	1.8	0.875	0.375	9	5	16.39	96.02	186.65
1.6	0.875	0.750	7	4	10.07	25.53	53.78	1.8	0.875	0.375	10	5	15.87	89.29	173.66
1.6	1.000	0.375	6	4	16.27	95.95	186.05	1.8	0.875	0.500	6	4	14.45	72.45	141.61
1.6	1.000	0.375	7	4	15.70	93.79	181.91	1.8	0.875	0.500	7	4	13.71	66.82	130.83
1.6	1.000	0.375	8	4	15.19	86.79	168.42	1.8	0.875	0.625	6	4	11.62	44.50	88.74
1.6	1.000	0.375	9	4	14.74	83.73	162.52	1.8	0.875	0.625	7	4	11.08	39.95	80.06
1.6	1.000	0.375	6	5	15.93	94.60	183.43	1.8	1.000	0.375	6	4	15.96	91.61	177.60
1.6	1.000	0.375	7	5	15.38	92.41	179.25	1.8	1.000	0.375	7	4	15.37	89.32	173.21
1.6	1.000	0.375	8	5	14.89	85.66	166.21	1.8	1.000	0.375	8	4	14.85	82.79	160.62
1.6	1.000	0.375	9	5	14.45	82.60	160.35	1.8	1.000	0.375	9	4	14.38	79.75	154.78
1.6	1.000	0.375	6	6	15.69	93.35	181.01	1.8	1.000	0.375	10	4	13.96	74.91	145.44
1.6	1.000	0.375	7	6	15.16	91.26	177.02	1.8	1.000	0.375	6	5	15.69	90.61	175.66
1.6	1.000	0.375	8	6	14.69	84.64	164.24	1.8	1.000	0.375	7	5	15.12	88.30	171.23
1.6	1.000	0.375	9	6	14.27	81.66	158.53	1.8	1.000	0.375	8	5	14.61	81.95	158.99
1.6	1.000	0.500	6	4	12.86	64.13	124.89	1.8	1.000	0.375	9	5	14.16	78.92	153.16
1.6	1.000	0.500	7	4	12.27	60.42	117.81	1.8	1.000	0.375	10	5	13.75	74.20	144.06
1.6	1.000	0.625	6	4	10.40	41.38	81.66	1.8	1.000	0.500	6	4	12.58	61.90	120.50
1.8	0.500	0.500	7	4	27.02	87.83	182.30	1.8	1.000	0.500	7	4	11.96	58.08	113.20
1.8	0.500	0.625	6	4	24.88	53.08	121.72	2.0	0.500	0.500	7	4	25.30	84.30	174.91
1.8	0.500	0.625	7	4	24.47	45.40	106.82	2.0	0.500	0.500	8	4	24.70	72.50	152.51
1.8	0.500	0.750	6	4	25.17	30.34	84.71	2.0	0.500	0.625	6	4	23.14	51.73	118.40
1.8	0.500	0.750	7	4	25.00	25.48	75.02	2.0	0.500	0.625	7	4	22.71	43.55	102.30
1.8	0.625	0.500	6	4	20.76	92.88	185.31	2.0	0.500	0.625	8	4	22.39	37.32	90.78
1.8	0.625	0.500	7	4	19.92	82.57	165.53	2.0	0.500	0.750	6	4	23.89	29.63	82.17
1.8	0.625	0.625	6	4	17.67	51.27	108.30	2.0	0.500	0.750	7	4	23.38	24.44	71.50
1.8	0.625	0.625	7	4	17.18	44.63	95.57	2.0	0.625	0.500	6	4	19.74	90.02	179.51
1.8	0.625	0.750	6	4	16.07	30.39	71.63	2.0	0.625	0.500	7	4	18.86	79.29	158.88
1.8	0.625	0.750	7	4	15.78	25.99	63.14	2.0	0.625	0.500	8	4	18.19	68.67	138.61
1.8	0.750	0.500	6	4	16.94	83.11	163.57	2.0	0.625	0.625	6	4	16.60	49.89	105.24
1.8	0.750	0.500	7	4	16.11	75.26	148.54	2.0	0.625	0.625	7	4	16.08	42.89	91.73
1.8	0.750	0.625	6	4	13.88	48.27	98.17	2.0	0.625	0.625	8	4	15.70	36.86	80.38
1.8	0.750	0.625	7	4	13.35	42.68	87.50	2.0	0.625	0.750	6	4	14.96	29.64	69.57
1.8	0.750	0.750	6	4	12.20	29.55	64.15	2.0	0.625	0.750	7	4	14.65	24.98	60.43
1.8	0.750	0.750	7	4	11.86	25.65	56.74	2.0	0.625	0.750	8	4	14.20	21.49	57.95
1.8	0.875	0.375	8	4	17.33	102.26	198.65	2.0	0.750	0.375	10	4	18.20	101.49	197.95
1.8	0.875	0.375	9	4	16.71	97.20	188.92	2.0	0.750	0.375	10	5	17.84	100.59	196.22
1.8	0.875	0.375	10	4	16.17	90.25	175.52	2.0	0.750	0.500	6	4	16.26	80.19	157.76

PLATE AREA - 450.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
2.0	0.750	0.500	7	4	15.40	72.14	142.32	4.0	0.500	0.375	9	4	18.30	94.91	187.41	4.0	0.500	0.375	9
2.0	0.750	0.500	8	4	14.74	63.19	125.19	4.0	0.500	0.375	10	4	17.61	86.29	170.95	4.0	0.500	0.375	10
2.0	0.750	0.625	6	4	13.17	46.85	95.18	4.0	0.500	0.375	11	4	17.03	79.02	156.95	4.0	0.500	0.375	11
2.0	0.750	0.625	7	4	12.61	41.04	84.04	4.0	0.500	0.375	12	4	16.55	72.92	145.29	4.0	0.500	0.375	12
2.0	0.750	0.625	8	4	12.19	35.47	73.50	4.0	0.500	0.375	13	4	16.13	67.71	135.26	4.0	0.500	0.375	13
2.0	0.750	0.750	6	4	11.45	28.78	62.30	4.0	0.500	0.375	14	4	15.77	63.16	126.56	4.0	0.500	0.375	14
2.0	0.750	0.750	7	4	11.09	24.69	54.44	4.0	0.500	0.500	8	3	13.69	50.94	105.76	4.0	0.500	0.500	8
2.0	0.875	0.375	8	4	16.76	97.04	188.47	4.0	0.500	0.500	9	3	13.26	45.21	94.75	4.0	0.500	0.500	9
2.0	0.875	0.375	9	4	16.13	92.11	178.99	4.0	0.500	0.500	10	3	12.93	40.44	85.74	4.0	0.500	0.500	10
2.0	0.875	0.375	10	4	15.58	85.65	166.54	4.0	0.500	0.500	11	3	12.65	36.73	78.64	4.0	0.500	0.500	11
2.0	0.875	0.375	8	5	16.49	96.18	186.81	4.0	0.500	0.625	8	3	11.78	27.15	63.11	4.0	0.500	0.625	8
2.0	0.875	0.375	9	5	15.88	91.23	177.29	4.0	0.500	0.625	9	3	11.67	23.71	56.36	4.0	0.500	0.625	9
2.0	0.875	0.375	10	5	15.35	84.94	165.17	4.0	0.500	0.625	10	3	12.01	21.14	51.65	4.0	0.500	0.625	10
2.0	0.875	0.500	6	4	13.95	69.57	135.91	4.0	0.500	0.625	11	3	11.95	24.57	47.66	4.0	0.500	0.625	11
2.0	0.875	0.500	7	4	13.19	63.86	124.97	4.0	0.500	0.750	8	3	11.69	15.74	43.47	4.0	0.500	0.750	8
2.0	0.875	0.500	8	4	12.58	56.68	111.23	4.0	0.500	0.750	9	3	11.36	13.57	38.93	4.0	0.500	0.750	9
2.0	0.875	0.625	6	4	11.12	43.06	85.77	4.0	0.500	0.750	10	3	11.66	12.06	36.29	4.0	0.500	0.750	10
2.0	0.875	0.625	7	4	10.56	38.37	76.82	4.0	0.500	0.750	11	3	11.45	10.72	33.48	4.0	0.500	0.750	11
2.0	0.875	0.625	8	4	10.13	33.44	67.48	4.0	0.625	0.375	8	3	15.70	87.84	171.30	4.0	0.625	0.375	8
2.0	1.000	0.375	6	4	15.49	86.56	167.76	4.0	0.625	0.375	9	3	14.96	81.23	158.63	4.0	0.625	0.375	9
2.0	1.000	0.375	7	4	14.90	84.22	163.27	4.0	0.625	0.375	10	3	14.33	74.42	145.57	4.0	0.625	0.375	10
2.0	1.000	0.375	8	4	14.38	78.22	151.71	4.0	0.625	0.375	11	3	13.80	69.53	136.19	4.0	0.625	0.375	11
2.0	1.000	0.375	9	4	13.91	75.27	146.05	4.0	0.625	0.375	12	3	13.33	64.53	126.61	4.0	0.625	0.375	12
2.0	1.000	0.375	10	4	13.49	70.80	137.43	4.0	0.625	0.375	13	3	12.93	60.78	119.43	4.0	0.625	0.375	13
2.0	1.000	0.375	6	5	15.28	85.83	166.34	4.0	0.625	0.375	14	3	12.57	56.96	112.09	4.0	0.625	0.375	14
2.0	1.000	0.375	7	5	14.70	83.45	161.79	4.0	0.625	0.375	8	4	15.86	87.68	170.92	4.0	0.625	0.375	8
2.0	1.000	0.375	8	5	14.19	77.60	150.52	4.0	0.625	0.375	9	4	15.11	80.62	157.42	4.0	0.625	0.375	9
2.0	1.000	0.375	9	5	13.74	74.65	144.85	4.0	0.625	0.375	10	4	14.48	74.14	145.01	4.0	0.625	0.375	10
2.0	1.000	0.375	10	5	13.32	70.28	136.42	4.0	0.625	0.375	11	4	13.94	69.00	135.14	4.0	0.625	0.375	11
2.0	1.000	0.500	6	4	12.19	59.14	115.08	4.0	0.625	0.375	12	4	13.47	64.21	125.97	4.0	0.625	0.375	12
2.0	1.000	0.500	7	4	11.56	55.30	107.73	4.0	0.625	0.375	13	4	13.06	60.32	118.50	4.0	0.625	0.375	13
2.0	1.000	0.500	8	4	11.03	49.77	97.14	4.0	0.625	0.375	14	4	12.70	56.64	111.44	4.0	0.625	0.375	14
4.0	0.500	0.375	9	3	17.93	96.12	189.85	4.0	0.625	0.500	8	3	11.14	46.59	93.21	4.0	0.625	0.500	8
4.0	0.500	0.375	10	3	17.25	86.83	172.06	4.0	0.625	0.500	9	3	10.67	42.04	84.52	4.0	0.625	0.500	9
4.0	0.500	0.375	11	3	16.68	80.03	159.01	4.0	0.750	0.375	10	3	10.29	37.85	76.57	4.0	0.750	0.375	10
4.0	0.500	0.375	12	3	16.21	73.53	146.55	4.0	0.750	0.375	8	3	13.37	69.77	135.46	4.0	0.750	0.375	8
4.0	0.500	0.375	13	3	15.80	68.58	137.06	4.0	0.750	0.375	9	3	12.79	65.73	127.72	4.0	0.750	0.375	9
4.0	0.500	0.375	14	3	15.45	63.77	127.83	4.0	0.750	0.375	10	3	12.29	61.13	118.90	4.0	0.750	0.375	10
											11	3	11.84	57.89	112.68				

PLATE AREA - 450.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
4.0	0.750	0.375	12	3	11.45	54.36	105.90
4.0	0.750	0.375	13	3	11.10	51.72	100.85
4.0	0.750	0.375	14	3	10.78	48.92	95.47
4.0	0.750	0.375	8	4	13.44	69.67	135.25
4.0	0.750	0.375	9	4	12.86	65.42	127.09
4.0	0.750	0.375	10	4	12.35	60.98	118.59
4.0	0.750	0.375	11	4	11.91	57.61	112.13
4.0	0.750	0.375	12	4	11.51	54.18	105.55
4.0	0.750	0.375	13	4	11.16	51.47	100.36
4.0	0.750	0.375	14	4	10.84	48.74	95.11
4.0	0.875	0.375	8	3	11.36	54.14	104.87
4.0	0.875	0.375	9	3	10.95	51.83	100.45
4.0	0.875	0.375	10	3	10.58	48.87	94.76
4.0	0.875	0.375	11	3	10.24	46.85	90.89
4.0	0.875	0.375	8	4	11.39	54.07	104.74
4.0	0.875	0.375	9	4	10.98	51.66	100.11
4.0	0.875	0.375	10	4	10.61	48.77	94.58
4.0	0.875	0.375	11	4	10.27	46.69	90.59

PLATE AREA - 500.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.0	0.500	0.625	5	5	25.22	71.44	154.47	1.0	1.000	0.375	7	7	14.39	100.38	194.77	1.0	1.000	0.375	7
1.0	0.500	0.625	6	5	24.88	70.76	152.92	1.0	1.000	0.375	8	7	14.12	98.14	190.42	1.0	1.000	0.375	8
1.0	0.500	0.625	5	6	24.64	70.76	152.92	1.0	1.000	0.375	6	8	14.32	99.05	192.11	1.0	1.000	0.375	6
1.0	0.500	0.625	6	6	24.29	54.58	121.31	1.0	1.000	0.375	7	8	14.03	98.14	190.42	1.0	1.000	0.375	7
1.0	0.500	0.750	5	5	23.96	41.37	103.16	1.0	1.000	0.375	8	8	13.78	91.35	177.31	1.0	1.000	0.375	8
1.0	0.500	0.750	6	5	23.76	41.11	102.46	1.0	1.000	0.500	5	5	12.61	79.44	154.45	1.0	1.000	0.500	5
1.0	0.500	0.750	6	6	23.58	41.11	102.46	1.0	1.000	0.500	6	5	12.22	76.51	148.75	1.0	1.000	0.500	6
1.0	0.500	0.750	6	6	23.36	31.14	82.49	1.0	1.000	0.500	5	6	12.07	76.51	148.75	1.0	1.000	0.500	5
1.0	0.625	0.500	6	6	19.65	95.59	189.69	1.0	1.000	0.500	6	6	11.71	66.53	129.54	1.0	1.000	0.500	6
1.0	0.625	0.625	5	5	17.97	67.64	138.65	1.0	1.000	0.625	5	5	10.19	51.59	101.16	1.0	1.000	0.625	5
1.0	0.625	0.625	6	5	17.65	66.51	136.29	1.2	0.500	0.625	5	5	28.48	78.67	171.28	1.2	0.500	0.625	5
1.0	0.625	0.625	5	6	17.41	66.51	136.29	1.2	0.500	0.625	6	5	27.97	60.67	136.22	1.2	0.500	0.625	6
1.0	0.625	0.625	6	5	17.09	52.41	109.04	1.2	0.500	0.750	5	5	27.19	45.68	115.47	1.2	0.500	0.750	5
1.0	0.625	0.750	5	5	16.48	40.49	89.68	1.2	0.500	0.750	6	5	26.89	34.60	93.45	1.2	0.500	0.750	6
1.0	0.625	0.750	6	5	16.27	40.05	88.65	1.2	0.625	0.625	5	5	20.17	74.39	152.99	1.2	0.625	0.625	5
1.0	0.625	0.750	5	6	16.08	40.05	88.65	1.2	0.625	0.625	6	5	19.66	58.48	122.30	1.2	0.625	0.625	6
1.0	0.625	0.750	6	6	15.87	30.94	70.90	1.2	0.625	0.750	5	5	18.59	44.74	99.78	1.2	0.625	0.750	5
1.0	0.750	0.500	6	6	15.86	86.24	169.35	1.2	0.625	0.750	6	5	18.27	34.52	79.96	1.2	0.625	0.750	6
1.0	0.750	0.625	5	5	14.11	62.74	125.51	1.2	0.750	0.500	6	5	18.19	96.20	189.08	1.2	0.750	0.500	6
1.0	0.750	0.625	6	5	13.80	61.20	122.39	1.2	0.750	0.625	5	5	15.75	68.75	137.75	1.2	0.750	0.625	5
1.0	0.750	0.625	5	6	13.57	61.20	122.39	1.2	0.750	0.625	6	5	15.25	55.15	111.61	1.2	0.750	0.625	6
1.0	0.750	0.625	6	6	13.27	49.31	99.52	1.2	0.750	0.625	5	5	14.05	42.70	89.76	1.2	0.750	0.625	5
1.0	0.750	0.750	5	5	12.51	38.70	81.06	1.2	0.750	0.750	6	5	13.71	33.53	72.13	1.2	0.750	0.750	6
1.0	0.750	0.750	6	5	12.31	38.04	79.63	1.2	0.875	0.500	5	5	16.04	100.27	195.47	1.2	0.875	0.500	5
1.0	0.750	0.750	5	6	12.13	38.04	79.63	1.2	0.875	0.500	6	5	15.38	84.89	165.85	1.2	0.875	0.500	6
1.0	0.750	0.750	6	6	11.92	29.96	64.06	1.2	0.875	0.625	5	5	13.08	62.44	123.42	1.2	0.875	0.625	5
1.0	0.875	0.500	5	5	14.51	93.06	181.39	1.2	0.875	0.625	6	5	12.60	51.12	101.71	1.2	0.875	0.625	6
1.0	0.875	0.500	6	5	14.07	89.64	174.71	1.2	0.875	0.750	5	5	11.36	40.08	81.64	1.2	0.875	0.750	5
1.0	0.875	0.500	5	6	13.86	89.64	174.71	1.2	0.875	0.750	6	5	11.02	32.03	66.24	1.2	0.875	0.750	6
1.0	0.875	0.500	6	6	13.45	76.36	149.13	1.2	0.875	0.750	5	5	16.12	103.01	199.94	1.2	0.875	0.750	5
1.0	0.875	0.625	5	5	11.77	57.29	113.16	1.2	1.000	0.375	8	5	15.76	100.96	195.94	1.2	1.000	0.375	8
1.0	0.875	0.625	6	5	11.46	55.49	109.58	1.2	1.000	0.375	8	6	15.44	99.10	192.34	1.2	1.000	0.375	8
1.0	0.875	0.625	5	6	11.27	55.49	109.58	1.2	1.000	0.500	5	5	13.90	85.08	165.42	1.2	1.000	0.500	5
1.0	0.875	0.625	6	6	10.97	45.70	90.79	1.2	1.000	0.500	6	5	13.34	73.55	143.23	1.2	1.000	0.500	6
1.0	0.875	0.750	5	5	10.17	36.45	74.10	1.2	1.000	0.625	5	5	11.28	55.89	109.64	1.2	1.000	0.625	5
1.0	1.000	0.375	7	6	14.79	102.87	199.60	1.2	1.000	0.625	6	5	10.84	46.68	91.98	1.2	1.000	0.625	6
1.0	1.000	0.375	8	6	14.50	99.05	192.11	1.4	0.500	0.625	6	4	30.69	63.08	142.58	1.4	0.500	0.625	6
1.0	1.000	0.375	6	7	14.70	102.87	199.60												

PLATE AREA - 500.0000

MAXIMUM STRESSES															
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.4	0.500	0.625	7	4	30.30	56.31	129.90	1.4	0.875	0.750	7	5	11.02	29.48	61.89
1.4	0.500	0.625	6	5	28.62	63.08	142.25	1.4	1.000	0.375	9	4	16.53	101.42	196.82
1.4	0.500	0.625	7	5	28.41	53.49	124.74	1.4	1.000	0.375	5	5	16.13	99.66	193.48
1.4	0.500	0.750	6	4	29.15	36.01	98.34	1.4	1.000	0.375	8	6	16.29	101.56	197.09
1.4	0.500	0.750	7	4	28.94	31.75	90.58	1.4	1.000	0.375	9	6	15.86	98.19	190.63
1.4	0.500	0.750	6	5	27.90	36.04	98.05	1.4	1.000	0.500	6	4	14.39	76.57	149.11
1.4	0.500	0.750	7	5	29.17	29.98	87.48	1.4	1.000	0.500	7	4	13.79	72.51	141.36
1.4	0.625	0.500	7	5	22.55	98.41	196.91	1.4	1.000	0.500	6	5	13.81	74.80	145.63
1.4	0.625	0.625	6	4	21.48	61.07	128.14	1.4	1.000	0.500	7	5	13.27	70.69	137.93
1.4	0.625	0.625	7	4	21.03	54.87	116.45	1.4	1.000	0.625	6	4	11.72	48.99	96.57
1.4	0.625	0.625	6	5	20.15	60.73	127.26	1.4	1.000	0.625	7	4	11.26	45.25	89.48
1.4	0.625	0.625	7	5	19.80	52.89	112.73	1.4	1.000	0.625	6	5	11.18	47.93	94.45
1.4	0.625	0.750	6	4	19.79	36.03	83.96	1.4	1.000	0.625	7	5	10.76	44.05	87.15
1.4	0.625	0.750	7	4	19.53	32.04	76.57	1.4	1.000	0.750	6	4	10.02	31.78	64.32
1.4	0.625	0.750	6	5	18.68	35.96	83.59								
1.4	0.625	0.750	7	5	18.49	30.72	74.18	1.6	0.500	0.625	6	4	29.46	63.30	143.26
1.4	0.750	0.500	6	4	19.04	100.82	198.25	1.6	0.500	0.625	7	4	29.04	53.23	127.84
1.4	0.750	0.500	7	4	19.04	92.81	182.94	1.6	0.500	0.750	6	4	28.25	36.20	98.88
1.4	0.750	0.500	6	5	18.75	98.90	194.41	1.6	0.500	0.750	7	4	28.44	31.10	89.12
1.4	0.750	0.500	7	5	18.08	90.22	177.93	1.6	0.625	0.500	7	4	23.22	99.97	199.84
1.4	0.750	0.625	6	4	16.59	57.81	117.20	1.6	0.625	0.500	7	5	22.15	97.58	195.29
1.4	0.750	0.625	7	4	16.11	52.33	106.84	1.6	0.625	0.625	6	4	20.75	61.16	128.36
1.4	0.750	0.625	6	5	15.66	57.11	115.69	1.6	0.625	0.625	7	4	20.24	54.05	114.82
1.4	0.750	0.625	7	5	15.25	50.78	103.87	1.6	0.625	0.750	6	4	19.02	36.19	84.30
1.4	0.750	0.750	6	4	14.83	35.12	75.80	1.6	0.625	0.750	7	4	18.72	31.53	75.47
1.4	0.750	0.750	7	4	14.53	31.43	68.92	1.6	0.750	0.500	6	4	19.47	99.95	196.51
1.4	0.750	0.750	6	5	14.04	34.89	75.18	1.6	0.750	0.500	7	4	18.61	91.23	179.81
1.4	0.750	0.750	7	5	13.79	30.42	67.04	1.6	0.750	0.500	6	5	18.65	98.59	193.78
1.4	0.875	0.500	6	4	16.66	88.77	173.48	1.6	0.750	0.500	7	5	17.87	89.27	176.06
1.4	0.875	0.500	7	4	15.97	82.87	162.19	1.6	0.750	0.625	6	4	16.15	57.71	116.97
1.4	0.875	0.500	6	5	13.90	86.78	169.55	1.6	0.750	0.625	7	4	15.60	51.61	105.37
1.4	0.875	0.500	7	5	15.27	80.66	157.92	1.6	0.750	0.750	6	4	14.33	35.21	75.95
1.4	0.875	0.625	6	4	13.67	53.69	106.90	1.6	0.750	0.750	7	4	13.99	31.02	68.04
1.4	0.875	0.625	7	4	13.18	49.05	98.13	1.6	0.875	0.500	6	4	16.49	87.55	171.06
1.4	0.875	0.625	6	5	12.97	52.73	104.95	1.6	0.875	0.500	7	4	15.72	81.22	158.93
1.4	0.875	0.625	7	5	12.54	47.71	95.54	1.6	0.875	0.500	6	5	15.90	86.10	168.18
1.4	0.875	0.625	6	4	11.90	33.65	69.72	1.6	0.875	0.500	7	5	15.18	79.56	155.73
1.4	0.875	0.750	7	4	11.58	30.32	63.49	1.6	0.875	0.625	6	4	13.40	53.38	106.26
1.4	0.875	0.750	6	5	11.31	33.25	68.81	1.6	0.875	0.625	7	4	12.85	48.33	95.65

PLATE AREA - 500.0000

MAXIMUM STRESSES															MAXIMUM STRESSES														
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL														
1.6	0.875	0.750	6	4	11.58	33.64	69.66	1.8	0.875	0.500	6	4	16.07	84.91	165.84														
1.6	0.875	0.750	7	4	11.20	29.95	62.69	1.8	0.875	0.500	7	4	15.25	78.33	153.23														
1.6	1.000	0.375	8	4	16.88	101.71	197.36	1.8	0.875	0.500	8	4	14.59	69.35	136.00														
1.6	1.000	0.375	9	4	16.38	98.13	190.46	1.8	0.875	0.625	6	4	12.93	52.16	103.76														
1.6	1.000	0.375	10	4	15.93	92.07	178.78	1.8	0.875	0.625	7	4	12.33	46.83	93.61														
1.6	1.000	0.375	8	5	16.55	100.38	194.78	1.8	0.875	0.625	8	4	11.87	40.69	81.91														
1.6	1.000	0.375	9	5	16.06	96.81	187.91	1.8	0.875	0.750	6	4	11.05	33.03	68.29														
1.6	1.000	0.375	10	5	15.63	90.94	176.59	1.8	0.875	0.750	7	4	10.65	29.09	60.80														
1.6	1.000	0.375	8	6	16.33	99.20	192.48	1.8	1.000	0.375	8	4	16.50	97.01	188.20														
1.6	1.000	0.375	9	6	15.86	95.71	185.79	1.8	1.000	0.375	9	4	15.98	93.46	181.37														
1.6	1.000	0.375	10	6	15.43	89.96	174.68	1.8	1.000	0.375	10	4	15.52	87.78	170.42														
1.6	1.000	0.500	6	4	14.30	75.15	146.31	1.8	1.000	0.375	8	5	16.24	96.03	186.31														
1.6	1.000	0.500	7	4	13.64	70.83	138.04	1.8	1.000	0.375	9	5	15.74	92.48	179.48														
1.6	1.000	0.500	6	5	13.86	73.84	143.73	1.8	1.000	0.375	10	5	15.28	86.95	168.81														
1.6	1.000	0.500	7	5	13.24	69.46	135.40	1.8	1.000	0.375	8	6	16.07	95.16	184.61														
1.6	1.000	0.625	6	4	11.57	48.51	95.57	1.8	1.000	0.375	9	6	15.58	91.67	177.90														
1.6	1.000	0.625	7	4	11.04	44.49	87.93	1.8	1.000	0.375	10	6	15.13	86.23	167.40														
1.8	0.500	0.500	8	4	29.43	88.09	184.03	1.8	1.000	0.500	6	4	13.99	72.53	141.16														
1.8	0.500	0.625	6	4	27.69	62.32	140.98	1.8	1.000	0.500	7	4	13.29	68.08	132.63														
1.8	0.500	0.625	7	4	27.24	53.35	123.57	1.8	1.000	0.500	8	4	12.72	61.12	119.28														
1.8	0.500	0.625	8	4	26.90	45.36	108.58	1.8	1.000	0.625	6	4	11.23	47.21	92.97														
1.8	0.500	0.750	6	4	27.40	35.69	97.19	1.8	1.000	0.625	7	4	10.66	43.03	85.00														
1.8	0.500	0.750	7	4	27.21	30.01	85.91	1.8	1.000	0.625	8	4	10.22	37.79	75.00														
1.8	0.625	0.500	7	4	22.16	96.82	193.53	2.0	0.500	0.500	8	4	27.49	85.05	177.64														
1.8	0.625	0.500	8	4	21.45	83.51	168.04	2.0	0.500	0.625	6	4	25.76	60.72	137.18														
1.8	0.625	0.625	6	4	19.66	60.12	126.11	2.0	0.500	0.625	7	4	25.29	51.15	118.35														
1.8	0.625	0.625	7	4	19.12	52.37	111.22	2.0	0.500	0.625	8	4	24.93	43.86	104.82														
1.8	0.625	0.625	8	4	18.71	44.74	96.78	2.0	0.500	0.750	6	4	26.12	34.84	94.38														
1.8	0.625	0.750	6	4	17.89	35.66	82.88	2.0	0.500	0.750	7	4	25.55	28.77	81.96														
1.8	0.625	0.750	7	4	17.56	30.53	72.98	2.0	0.500	0.750	8	4	26.18	24.57	74.49														
1.8	0.750	0.500	6	4	18.84	97.41	191.46	2.0	0.625	0.500	7	4	20.98	92.95	185.72														
1.8	0.750	0.500	7	4	17.92	88.23	173.87	2.0	0.625	0.500	8	4	20.24	80.51	161.94														
1.8	0.750	0.500	8	4	17.21	77.04	152.41	2.0	0.625	0.625	6	4	18.47	58.49	122.56														
1.8	0.750	0.625	6	4	15.45	56.58	114.62	2.0	0.625	0.625	7	4	17.90	50.31	106.75														
1.8	0.750	0.625	7	4	14.85	50.05	102.14	2.0	0.625	0.625	8	4	17.47	43.24	93.42														
1.8	0.750	0.625	8	4	14.41	43.07	88.88	2.0	0.625	0.750	6	4	16.66	34.77	80.55														
1.8	0.750	0.750	6	4	13.58	34.64	74.59	2.0	0.625	0.750	7	4	16.31	29.33	69.88														
1.8	0.750	0.750	7	4	13.20	30.10	65.93																						

PLATE AREA - 500.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
2.0	0.625	0.750	8	4	16.32	25.12	62.13	4.0	0.500	0.375	14	3	17.17	74.68	149.29
2.0	0.750	0.500	7	4	17.13	84.56	166.57	4.0	0.500	0.375	15	3	16.83	70.27	140.82
2.0	0.750	0.500	8	4	16.39	74.06	146.47	4.0	0.500	0.375	10	4	19.57	101.05	199.83
2.0	0.750	0.625	6	4	14.65	54.91	111.13	4.0	0.500	0.375	11	4	18.94	92.54	183.42
2.0	0.750	0.625	7	4	14.03	48.11	98.09	4.0	0.500	0.375	12	4	18.40	85.40	169.76
2.0	0.750	0.625	8	4	13.57	41.58	85.71	4.0	0.500	0.375	13	4	17.94	79.29	158.00
2.0	0.750	0.750	6	4	12.75	33.73	72.46	4.0	0.500	0.375	14	4	17.54	73.97	147.81
2.0	0.750	0.750	7	4	12.35	28.96	63.27	4.0	0.500	0.375	15	4	17.19	69.37	138.96
2.0	0.750	0.750	8	4	12.06	24.88	55.64	4.0	0.500	0.500	9	3	14.73	52.91	110.28
2.0	0.875	0.375	10	4	17.32	100.37	195.12	4.0	0.500	0.500	10	3	14.36	47.35	99.74
2.0	0.875	0.375	11	4	16.78	95.38	185.50	4.0	0.500	0.500	11	3	14.06	43.01	91.40
2.0	0.875	0.375	10	5	17.05	99.54	193.51	4.0	0.500	0.625	9	3	12.97	27.75	65.22
2.0	0.875	0.375	11	5	16.53	94.54	183.89	4.0	0.500	0.625	10	3	13.34	24.75	59.71
2.0	0.875	0.500	7	4	14.67	74.84	146.35	4.0	0.500	0.625	11	3	13.28	29.10	56.45
2.0	0.875	0.500	8	4	13.99	66.43	130.23	4.0	0.500	0.750	9	3	12.95	15.86	44.94
2.0	0.875	0.625	6	4	12.37	50.45	100.29	4.0	0.500	0.750	10	3	13.30	14.10	41.88
2.0	0.875	0.625	7	4	11.74	44.97	89.82	4.0	0.500	0.750	11	3	13.06	12.53	38.60
2.0	0.875	0.625	8	4	11.27	39.20	78.84	4.0	0.625	0.375	9	3	16.62	95.12	185.66
2.0	0.875	0.750	6	4	10.47	32.10	66.23	4.0	0.625	0.375	10	3	15.92	87.14	170.34
2.0	0.875	0.750	7	4	10.04	28.00	58.40	4.0	0.625	0.375	11	3	15.33	81.42	159.35
2.0	1.000	0.375	7	4	16.56	98.68	191.32	4.0	0.625	0.375	12	3	14.81	75.57	148.12
2.0	1.000	0.375	8	4	15.98	91.65	177.77	4.0	0.625	0.375	13	3	14.36	71.18	139.70
2.0	1.000	0.375	9	4	15.46	88.21	171.14	4.0	0.625	0.375	14	3	13.97	66.70	131.10
2.0	1.000	0.375	10	4	14.99	82.96	161.03	4.0	0.625	0.375	15	3	13.61	63.24	124.45
2.0	1.000	0.375	11	4	14.57	79.72	154.78	4.0	0.625	0.375	9	4	16.79	94.41	184.24
2.0	1.000	0.375	7	5	16.34	97.78	189.59	4.0	0.625	0.375	10	4	16.09	86.82	169.69
2.0	1.000	0.375	8	5	15.77	90.93	176.37	4.0	0.625	0.375	11	4	15.49	80.80	158.12
2.0	1.000	0.375	9	5	15.27	87.48	169.73	4.0	0.625	0.375	12	4	14.97	75.20	147.37
2.0	1.000	0.375	10	5	14.81	82.35	159.85	4.0	0.625	0.375	13	4	14.52	70.64	138.61
2.0	1.000	0.375	11	5	14.39	79.11	153.60	4.0	0.625	0.375	14	4	14.12	66.32	130.34
2.0	1.000	0.500	7	4	12.85	64.81	126.21	4.0	0.625	0.375	15	4	13.76	62.75	123.48
2.0	1.000	0.500	8	4	12.26	58.32	113.78	4.0	0.625	0.500	9	3	11.85	49.20	98.67
2.0	1.000	0.625	6	4	10.81	45.49	89.51	4.0	0.625	0.500	10	3	11.43	44.30	89.34
2.0	1.000	0.625	7	4	10.23	41.23	81.38	4.0	0.625	0.500	11	3	11.08	40.70	82.46
4.0	0.500	0.375	11	3	18.54	93.72	185.82	4.0	0.750	0.375	9	3	14.21	76.98	149.56
4.0	0.500	0.375	12	3	18.01	86.11	171.22	4.0	0.750	0.375	10	3	13.65	71.59	139.22
4.0	0.500	0.375	13	3	17.56	80.31	160.09	4.0	0.750	0.375	11	3	13.16	67.79	131.92
								4.0	0.750	0.375	12	3	12.72	63.66	123.97

PLATE AREA - 500.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
4.0	0.750	0.375	13	3	12.33	60.57	118.05
4.0	0.750	0.375	14	3	11.98	57.28	111.74
4.0	0.750	0.375	15	3	11.66	54.74	106.86
4.0	0.750	0.375	9	4	14.29	76.61	148.83
4.0	0.750	0.375	10	4	13.72	71.41	138.86
4.0	0.750	0.375	11	4	13.23	67.47	131.28
4.0	0.750	0.375	12	4	12.79	63.45	123.57
4.0	0.750	0.375	13	4	12.40	60.28	117.48
4.0	0.750	0.375	14	4	12.05	57.07	111.33
4.0	0.750	0.375	15	4	11.73	54.48	106.34
4.0	0.750	0.500	9	3	10.19	44.03	86.78
4.0	0.875	0.375	9	3	12.16	60.71	117.67
4.0	0.875	0.375	10	3	11.75	57.23	110.99
4.0	0.875	0.375	11	3	11.38	54.87	106.46
4.0	0.875	0.375	12	3	11.04	52.09	101.12
4.0	0.875	0.375	13	3	10.73	50.06	97.22
4.0	0.875	0.375	14	3	10.44	47.77	92.83
4.0	0.875	0.375	15	3	10.18	46.02	89.46
4.0	0.875	0.375	9	4	12.20	60.51	117.27
4.0	0.875	0.375	10	4	11.79	57.13	110.78
4.0	0.875	0.375	11	4	11.41	54.69	106.10
4.0	0.875	0.375	12	4	11.07	51.97	100.89
4.0	0.875	0.375	13	4	10.76	49.89	96.89
4.0	0.875	0.375	14	4	10.48	47.65	92.59
4.0	0.875	0.375	15	4	10.22	45.87	89.17
4.0	1.000	0.375	9	3	10.38	47.34	91.64
4.0	1.000	0.375	10	3	10.09	45.14	87.40
4.0	1.000	0.375	9	4	10.40	47.23	91.42
4.0	1.000	0.375	10	4	10.11	45.07	87.28

PLATE AREA - 550.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.625	5	5	27.72	82.69	177.21	1.0	1.000	0.625	6	5	10.88	57.50	112.63
1.0	0.500	0.625	6	5	27.33	81.91	175.45	1.0	1.000	0.625	5	6	10.70	57.50	112.63
1.0	0.500	0.625	5	6	27.07	81.91	175.45	1.0	1.000	0.625	6	6	10.40	48.33	95.02
1.0	0.500	0.625	6	6	26.68	63.21	138.93								
1.0	0.500	0.750	5	5	26.32	47.98	117.38	1.2	0.500	0.625	5	5	31.29	90.99	196.27
1.0	0.500	0.750	6	5	26.08	47.69	116.60	1.2	0.500	0.625	6	5	30.72	70.23	155.83
1.0	0.500	0.750	5	6	25.88	47.69	116.60	1.2	0.500	0.750	5	5	29.86	52.92	131.22
1.0	0.500	0.750	6	6	25.64	36.16	93.57	1.2	0.500	0.750	6	5	29.50	40.14	105.84
1.0	0.625	0.625	5	5	19.76	78.24	159.64	1.2	0.625	0.625	5	5	22.17	86.00	176.00
1.0	0.625	0.625	6	5	19.40	76.94	156.94	1.2	0.625	0.625	6	5	21.61	67.63	140.55
1.0	0.625	0.625	5	6	19.14	76.94	156.94	1.2	0.625	0.750	5	5	20.42	51.76	114.22
1.0	0.625	0.625	6	6	18.78	60.64	125.42	1.2	0.625	0.750	6	5	20.06	39.96	91.32
1.0	0.625	0.750	5	5	18.10	46.89	102.77	1.2	0.750	0.625	5	5	17.32	79.46	158.77
1.0	0.625	0.750	6	5	17.86	46.38	101.60	1.2	0.750	0.625	6	5	16.77	63.74	128.55
1.0	0.625	0.750	5	6	17.67	46.38	101.60	1.2	0.750	0.750	5	5	15.44	49.38	103.14
1.0	0.625	0.750	6	6	17.42	35.85	81.08	1.2	0.750	0.750	6	5	15.07	38.78	82.75
1.0	0.750	0.500	6	6	17.44	99.66	195.48	1.2	0.875	0.500	6	5	16.93	98.04	191.44
1.0	0.750	0.625	5	5	15.52	72.55	144.76	1.2	0.875	0.500	7	5	16.38	91.71	179.41
1.0	0.750	0.625	6	5	15.17	70.78	141.18	1.2	0.875	0.625	5	5	14.39	72.15	142.39
1.0	0.750	0.625	5	6	14.93	70.78	141.18	1.2	0.875	0.625	6	5	13.86	59.07	117.28
1.0	0.750	0.625	6	6	14.59	57.02	114.71	1.2	0.875	0.750	5	5	12.49	46.33	94.01
1.0	0.750	0.750	5	5	13.76	44.79	93.23	1.2	0.875	0.750	6	5	12.12	37.02	76.19
1.0	0.750	0.750	6	5	13.52	44.03	91.60	1.2	1.000	0.500	6	5	14.68	84.94	165.34
1.0	0.750	0.750	5	6	13.33	44.03	91.60	1.2	1.000	0.500	7	5	14.19	80.71	157.31
1.0	0.750	0.750	6	6	13.09	34.68	73.57	1.2	1.000	0.625	5	5	12.41	64.57	126.55
1.0	0.875	0.500	6	6	14.80	88.22	172.19	1.2	1.000	0.625	6	5	11.92	53.93	106.12
1.0	0.875	0.625	5	5	12.95	66.23	130.61	1.2	1.000	0.750	5	5	10.58	42.91	85.65
1.0	0.875	0.625	6	5	12.61	64.16	126.51	1.2	1.000	0.750	6	5	10.21	34.90	70.34
1.0	0.875	0.625	5	6	12.40	64.16	126.51								
1.0	0.875	0.625	6	6	12.07	52.83	104.75	1.4	0.500	0.625	6	4	33.81	72.96	162.95
1.0	0.875	0.750	5	5	11.18	42.16	85.40	1.4	0.500	0.625	7	4	33.38	65.20	148.38
1.0	0.875	0.750	6	5	10.95	41.16	83.34	1.4	0.500	0.625	6	5	31.44	72.98	162.64
1.0	0.875	0.750	5	6	10.76	41.16	83.34	1.4	0.500	0.625	7	5	31.22	61.85	142.21
1.0	0.875	0.750	6	6	10.54	33.04	67.77	1.4	0.500	0.750	6	4	32.11	41.74	111.30
1.0	1.000	0.500	5	5	13.88	91.75	178.36	1.4	0.500	0.750	7	4	31.87	36.88	102.40
1.0	1.000	0.500	6	5	13.45	88.38	171.80	1.4	0.500	0.750	6	5	30.17	41.78	111.02
1.0	1.000	0.500	5	6	13.28	88.38	171.80	1.4	0.500	0.750	7	5	31.21	34.74	98.63
1.0	1.000	0.500	6	6	12.89	76.85	149.57	1.4	0.625	0.625	6	4	23.66	70.57	147.14
1.0	1.000	0.625	5	5	11.21	59.62	116.81	1.4	0.625	0.625	7	4	23.16	63.47	133.71

PLATE AREA - 550.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.4	0.625	0.625	6	5	22.14	70.20	146.19	1.6	0.500	0.750	6	4	30.74	41.94	111.96
1.4	0.625	0.625	7	5	21.76	61.11	129.28	1.6	0.500	0.750	7	4	30.51	36.09	100.75
1.4	0.625	0.750	6	4	21.80	41.68	95.82	1.6	0.500	0.750	6	5	30.06	42.00	111.82
1.4	0.625	0.750	7	4	21.51	37.11	87.33	1.6	0.500	0.750	7	5	30.98	34.47	98.04
1.4	0.625	0.750	6	5	20.52	41.61	95.43	1.6	0.625	0.500	8	4	24.86	99.20	199.01
1.4	0.625	0.750	7	5	20.31	35.52	84.44	1.6	0.625	0.500	8	5	23.69	97.85	196.35
1.4	0.750	0.625	6	4	18.27	66.78	134.89	1.6	0.625	0.625	6	4	22.85	70.66	147.39
1.4	0.750	0.625	7	4	17.75	60.49	122.97	1.6	0.625	0.625	7	4	22.30	62.48	131.78
1.4	0.750	0.625	6	5	17.22	65.99	133.20	1.6	0.625	0.625	6	5	21.69	70.47	146.84
1.4	0.750	0.625	7	5	16.77	58.66	119.48	1.6	0.625	0.625	7	5	21.22	60.67	128.45
1.4	0.750	0.750	6	4	16.34	40.58	86.89	1.6	0.625	0.750	6	4	20.95	41.85	96.22
1.4	0.750	0.750	7	4	16.01	36.36	79.00	1.6	0.625	0.750	7	4	20.62	36.50	86.06
1.4	0.750	0.750	6	5	15.43	40.33	86.21	1.6	0.625	0.750	6	5	19.97	41.84	96.03
1.4	0.750	0.750	7	5	15.15	35.15	76.74	1.6	0.625	0.750	7	5	19.70	35.28	83.93
1.4	0.875	0.500	6	5	17.49	100.21	195.67	1.6	0.750	0.500	8	4	19.77	91.74	181.24
1.4	0.875	0.500	7	5	16.80	93.16	182.24	1.6	0.750	0.500	8	5	18.98	90.39	178.59
1.4	0.875	0.625	6	4	15.05	62.00	123.20	1.6	0.750	0.625	6	4	17.79	66.64	134.62
1.4	0.875	0.625	7	4	14.52	56.68	113.10	1.6	0.750	0.625	7	4	17.18	59.63	121.25
1.4	0.875	0.625	6	5	14.27	60.91	120.98	1.6	0.750	0.625	6	5	16.98	66.13	133.50
1.4	0.875	0.625	7	5	13.79	55.11	110.08	1.6	0.750	0.625	7	5	16.44	58.24	118.63
1.4	0.875	0.750	6	4	13.11	38.87	80.13	1.6	0.750	0.750	6	4	15.79	40.68	87.06
1.4	0.875	0.750	7	4	12.76	35.05	72.98	1.6	0.750	0.750	7	4	15.41	35.87	77.96
1.4	0.875	0.750	6	5	12.43	38.41	79.11	1.6	0.750	0.750	6	5	15.10	40.53	86.65
1.4	0.875	0.750	7	5	12.12	34.06	71.08	1.6	0.750	0.750	7	5	14.76	34.94	76.28
1.4	1.000	0.500	6	5	15.20	86.36	168.09	1.6	0.875	0.500	6	4	18.16	101.08	197.36
1.4	1.000	0.500	7	5	14.60	81.64	159.10	1.6	0.875	0.500	7	4	17.31	93.79	183.39
1.4	1.000	0.625	6	4	12.91	56.57	111.37	1.6	0.875	0.500	6	4	16.63	82.86	162.40
1.4	1.000	0.625	7	4	12.39	52.28	103.21	1.6	0.875	0.500	6	5	17.49	99.41	194.07
1.4	1.000	0.625	6	5	12.30	55.36	108.95	1.6	0.875	0.500	7	5	16.70	91.86	179.68
1.4	1.000	0.625	7	5	11.84	50.88	100.50	1.6	0.875	0.500	8	5	16.06	81.55	159.84
1.4	1.000	0.750	6	4	11.04	36.70	74.04	1.6	0.875	0.625	6	4	14.76	61.63	122.43
1.4	1.000	0.750	7	4	10.67	33.36	67.76	1.6	0.875	0.625	7	4	14.15	55.82	111.37
1.4	1.000	0.750	6	5	10.50	36.09	72.76	1.6	0.875	0.625	6	5	14.16	60.87	120.88
1.4	1.000	0.750	7	5	10.17	32.48	66.04	1.6	0.875	0.625	7	5	13.60	54.64	109.11
1.6	0.500	0.625	6	4	32.45	73.20	163.71	1.6	0.875	0.750	6	4	12.75	38.85	80.05
1.6	0.500	0.625	7	4	31.99	63.92	145.96	1.6	0.875	0.750	7	4	12.34	34.61	72.04
1.6	0.500	0.625	6	5	30.61	73.29	163.62	1.6	0.875	0.750	6	5	12.23	38.56	79.38
1.6	0.500	0.625	7	5	30.31	61.38	141.39	1.6	1.000	0.500	7	5	11.86	33.86	70.62
													15.74	86.75	168.84

PLATE AREA - 550.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	1.000	0.500	7	4	15.02	81.78	159.33	1.8	0.875	0.625	8	4	13.07	46.98	94.31
1.6	1.000	0.500	8	4	14.42	73.30	143.01	1.8	0.875	0.750	6	4	12.18	38.13	78.48
1.6	1.000	0.500	6	5	15.24	85.24	165.88	1.8	0.875	0.750	7	4	11.73	33.60	69.86
1.6	1.000	0.500	7	5	14.56	80.20	156.27	1.8	0.875	0.750	8	4	11.39	28.88	60.93
1.6	1.000	0.500	8	5	14.00	72.12	140.73	1.8	1.000	0.375	10	4	17.08	101.32	196.69
1.6	1.000	0.625	6	4	12.73	56.00	110.20	1.8	1.000	0.375	11	4	16.61	97.42	189.16
1.6	1.000	0.625	7	4	12.15	51.38	101.40	1.8	1.000	0.375	10	5	16.81	100.37	194.84
1.6	1.000	0.625	6	5	12.27	55.12	108.45	1.8	1.000	0.375	11	5	16.36	96.47	187.34
1.6	1.000	0.625	7	5	11.73	50.33	99.38	1.8	1.000	0.375	10	6	16.65	99.53	193.22
1.6	1.000	0.750	6	4	10.80	36.57	73.72	1.8	1.000	0.375	11	6	16.21	95.70	185.83
1.6	1.000	0.750	7	4	10.38	32.92	66.83	1.8	1.000	0.500	6	4	15.40	83.72	162.89
1.6	1.000	0.750	6	5	10.39	36.15	72.83	1.8	1.000	0.500	8	4	14.63	78.59	153.06
1.6	1.000	0.750	7	5	10.01	32.25	65.56	1.8	1.000	0.500	6	4	14.00	70.56	137.63
1.8	0.500	0.625	6	4	30.50	72.05	161.13	1.8	1.000	0.625	6	4	12.36	54.50	107.19
1.8	0.500	0.625	7	4	30.01	61.72	141.06	1.8	1.000	0.625	7	4	11.74	49.68	98.00
1.8	0.500	0.625	8	4	29.64	52.50	123.72	1.8	1.000	0.625	8	4	11.25	43.63	86.44
1.8	0.500	0.750	6	4	29.50	41.34	110.13	1.8	1.000	0.750	6	4	10.39	35.80	72.09
1.8	0.500	0.750	7	4	29.29	34.80	97.17	2.0	0.500	0.625	7	4	27.87	59.15	135.12
1.8	0.500	0.750	8	4	29.81	29.45	87.34	2.0	0.500	0.625	8	4	27.47	50.74	119.46
1.8	0.625	0.500	8	4	23.62	96.45	193.49	2.0	0.500	0.750	7	4	27.60	33.35	92.76
1.8	0.625	0.625	6	4	21.66	69.45	144.80	2.0	0.500	0.750	8	4	28.29	28.50	84.11
1.8	0.625	0.625	7	4	21.06	60.51	127.64	2.0	0.625	0.500	8	4	22.29	92.96	186.44
1.8	0.625	0.625	8	4	20.61	51.71	110.93	2.0	0.625	0.625	7	4	19.72	58.12	122.50
1.8	0.625	0.750	6	4	19.71	41.22	94.63	2.0	0.625	0.625	8	4	19.25	49.96	107.08
1.8	0.625	0.750	7	4	19.35	35.32	83.23	2.0	0.625	0.750	7	4	17.98	33.92	79.72
1.8	0.625	0.750	8	4	19.08	30.03	73.35	2.0	0.625	0.750	8	4	17.69	29.06	70.74
1.8	0.750	0.500	8	4	18.95	88.96	175.70	2.0	0.750	0.500	7	4	18.86	97.62	192.06
1.8	0.750	0.625	6	4	17.01	65.33	131.90	2.0	0.750	0.500	8	4	18.05	85.51	168.83
1.8	0.750	0.625	7	4	16.36	57.81	117.51	2.0	0.750	0.625	7	4	15.45	55.56	112.84
1.8	0.750	0.625	8	4	15.87	49.75	102.17	2.0	0.750	0.625	8	4	14.94	48.02	98.52
1.8	0.750	0.750	6	4	14.96	40.01	85.52	2.0	0.750	0.750	7	4	13.61	33.46	72.51
1.8	0.750	0.750	7	4	14.54	34.79	75.54	2.0	0.750	0.750	8	4	13.28	28.74	63.68
1.8	0.750	0.750	8	4	14.24	29.72	65.99	2.0	0.875	0.500	7	4	16.15	86.39	168.83
1.8	0.875	0.500	6	4	17.69	98.02	191.33	2.0	0.875	0.500	8	4	15.40	76.68	150.20
1.8	0.875	0.500	7	4	16.78	90.43	176.79	2.0	0.875	0.625	7	4	12.93	51.92	103.47
1.8	0.875	0.500	8	4	16.06	80.06	156.87	2.0	0.875	0.625	8	4	12.41	45.25	90.77
1.8	0.875	0.625	6	4	14.23	60.21	119.55	2.0	0.875	0.750	7	4	11.06	32.33	67.10
1.8	0.875	0.625	7	4	13.58	54.08	107.85	2.0	0.875	0.750	8	4	10.71	27.91	58.77

PLATE AREA - 550.0000

MAXIMUM STRESSES															MAXIMUM STRESSES				
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL				
2.0	1.000	0.375	9	4	17.01	101.81	197.53	4.0	0.625	0.375	12	3	16.29	87.17	170.73				
2.0	1.000	0.375	10	4	16.50	95.76	185.85	4.0	0.625	0.375	13	3	15.80	82.11	161.00				
2.0	1.000	0.375	11	4	16.03	92.01	178.63	4.0	0.625	0.375	14	3	15.36	76.95	151.08				
2.0	1.000	0.375	9	5	16.79	100.97	195.90	4.0	0.625	0.375	15	3	14.98	72.95	143.40				
2.0	1.000	0.375	10	5	16.29	95.05	184.49	4.0	0.625	0.375	16	3	14.63	68.87	135.56				
2.0	1.000	0.375	11	5	15.83	91.31	177.28	4.0	0.625	0.375	10	4	17.70	100.15	195.63				
2.0	1.000	0.375	9	6	16.66	100.27	194.56	4.0	0.625	0.375	11	4	17.04	93.21	182.28				
2.0	1.000	0.375	10	6	16.16	94.44	183.30	4.0	0.625	0.375	12	4	16.47	86.74	169.87				
2.0	1.000	0.375	11	6	15.71	90.73	176.16	4.0	0.625	0.375	13	4	15.97	81.49	159.76				
2.0	1.000	0.500	7	4	14.74	74.81	145.64	4.0	0.625	0.375	14	4	15.53	76.51	150.20				
2.0	1.000	0.500	8	4	13.49	67.32	131.27	4.0	0.625	0.375	15	4	15.14	72.39	142.28				
2.0	1.000	0.625	7	4	11.26	47.60	93.83	4.0	0.625	0.375	16	4	14.79	68.44	134.70				
2.0	1.000	0.625	8	4	10.75	41.91	82.98	4.0	0.625	0.500	9	3	13.04	56.73	113.51				
4.0	0.500	0.375	12	3	19.81	99.34	197.14	4.0	0.625	0.500	10	3	12.57	51.08	102.75				
4.0	0.500	0.375	13	3	19.31	92.65	184.29	4.0	0.625	0.500	11	3	12.19	46.92	94.80				
4.0	0.500	0.375	14	3	18.88	86.16	171.82	4.0	0.625	0.500	12	3	11.87	43.02	87.35				
4.0	0.500	0.375	15	3	18.51	81.07	162.04	4.0	0.625	0.625	9	3	10.38	31.35	66.59				
4.0	0.500	0.375	16	3	18.18	76.07	152.44	4.0	0.625	0.625	10	3	10.12	28.02	60.35				
4.0	0.500	0.375	12	4	20.25	98.52	195.46	4.0	0.750	0.375	9	3	15.63	88.81	172.52				
4.0	0.500	0.375	13	4	19.74	91.47	181.89	4.0	0.750	0.375	10	3	15.01	82.59	160.58				
4.0	0.500	0.375	14	4	19.31	85.33	170.13	4.0	0.750	0.375	11	3	14.47	78.21	152.15				
4.0	0.500	0.375	15	4	18.92	80.03	159.91	4.0	0.750	0.375	12	3	13.99	73.43	142.98				
4.0	0.500	0.375	16	4	18.58	75.28	150.80	4.0	0.750	0.375	13	3	13.56	69.87	136.14				
4.0	0.500	0.500	9	3	16.20	61.02	126.54	4.0	0.750	0.375	14	3	13.17	66.08	128.85				
4.0	0.500	0.500	10	3	15.79	54.61	114.39	4.0	0.750	0.375	15	3	12.82	63.15	123.22				
4.0	0.500	0.500	11	3	15.46	49.60	104.77	4.0	0.750	0.375	16	3	12.51	60.06	117.28				
4.0	0.500	0.500	12	3	15.18	52.13	100.97	4.0	0.750	0.375	9	4	15.71	88.38	171.68				
4.0	0.500	0.625	9	3	14.20	31.99	74.42	4.0	0.750	0.375	10	4	15.10	82.38	160.16				
4.0	0.500	0.625	10	3	14.60	28.55	68.08	4.0	0.750	0.375	11	4	14.55	77.83	151.41				
4.0	0.500	0.625	11	3	14.53	33.88	65.73	4.0	0.750	0.375	12	4	14.07	73.20	142.51				
4.0	0.500	0.625	12	3	14.78	33.37	64.73	4.0	0.750	0.375	13	4	13.64	69.54	135.48				
4.0	0.500	0.750	9	3	14.48	18.27	51.12	4.0	0.750	0.375	14	4	13.25	65.84	128.37				
4.0	0.500	0.750	10	3	14.86	16.26	47.60	4.0	0.750	0.375	15	4	12.90	62.84	122.61				
4.0	0.500	0.750	11	3	14.61	14.45	43.82	4.0	0.750	0.500	16	4	12.58	59.82	116.81				
4.0	0.500	0.750	12	3	14.84	21.92	42.71	4.0	0.750	0.500	9	3	11.20	50.77	99.96				
4.0	0.625	0.375	10	3	17.51	100.53	196.38	4.0	0.750	0.500	10	3	10.74	46.17	91.18				
4.0	0.625	0.375	11	3	16.86	93.92	183.69	4.0	0.750	0.500	11	3	10.36	42.84	84.83				
4.0	0.625	0.375	11	3	16.86	93.92	183.69	4.0	0.750	0.500	12	3	10.03	39.55	78.54				

PLATE AREA - 550.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
4.0	0.875	0.375	9	3	13.38	70.04	135.77
4.0	0.875	0.375	10	3	12.92	66.03	128.06
4.0	0.875	0.375	11	3	12.51	63.30	122.82
4.0	0.875	0.375	12	3	12.14	60.09	116.66
4.0	0.875	0.375	13	3	11.80	57.75	112.15
4.0	0.875	0.375	14	3	11.49	55.11	107.08
4.0	0.875	0.375	15	3	11.20	53.09	103.19
4.0	0.875	0.375	16	3	10.94	50.88	98.94
4.0	0.875	0.375	9	4	13.42	69.81	135.31
4.0	0.875	0.375	10	4	12.96	65.91	127.82
4.0	0.875	0.375	11	4	12.55	63.10	122.42
4.0	0.875	0.375	12	4	12.18	59.96	116.39
4.0	0.875	0.375	13	4	11.84	57.56	111.78
4.0	0.875	0.375	14	4	11.53	54.97	106.81
4.0	0.875	0.375	15	4	11.24	52.92	102.86
4.0	0.875	0.375	16	4	10.97	50.74	98.68
4.0	1.000	0.375	9	3	11.42	54.63	105.76
4.0	1.000	0.375	10	3	11.10	52.08	100.86
4.0	1.000	0.375	11	3	10.80	50.45	97.74
4.0	1.000	0.375	12	3	10.53	48.35	93.71
4.0	1.000	0.375	13	3	10.28	46.87	90.86
4.0	1.000	0.375	14	3	10.04	45.10	87.45
4.0	1.000	0.375	9	4	11.44	54.50	105.50
4.0	1.000	0.375	10	4	11.12	52.00	100.72
4.0	1.000	0.375	11	4	10.82	50.34	97.51
4.0	1.000	0.375	12	4	10.55	48.27	93.55
4.0	1.000	0.375	13	4	10.30	46.76	90.65
4.0	1.000	0.375	14	4	10.06	45.01	87.29

PLATE AREA - 600.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.625	6	5	29.77	93.60	198.98	1.0	1.000	0.750	5	5	10.37	44.80	89.15
1.0	0.500	0.625	5	6	29.50	93.60	198.97	1.0	1.000	0.750	6	5	10.11	43.47	86.48
1.0	0.500	0.625	6	6	29.07	72.28	157.34	1.2	0.500	0.625	6	5	33.47	80.27	176.29
1.0	0.500	0.750	5	5	28.67	54.92	132.17	1.2	0.500	0.625	7	5	33.33	80.04	168.39
1.0	0.500	0.750	6	5	28.39	54.59	131.30	1.2	0.500	0.625	6	6	32.93	79.73	175.04
1.0	0.500	0.750	5	6	28.19	54.59	131.30	1.2	0.500	0.625	7	6	32.83	68.27	154.23
1.0	0.500	0.750	6	6	27.91	41.43	105.07	1.2	0.500	0.750	6	5	32.12	45.96	118.69
1.0	0.625	0.625	5	5	21.55	89.35	181.60	1.2	0.500	0.750	7	5	32.08	46.72	109.90
1.0	0.625	0.625	6	5	21.19	87.88	178.55	1.2	0.500	0.750	6	6	31.75	45.78	118.13
1.0	0.625	0.625	5	6	20.86	87.88	178.55	1.2	0.500	0.750	7	6	31.74	38.42	105.55
1.0	0.625	0.625	6	6	20.47	69.27	142.56	1.2	0.625	0.625	6	5	23.56	77.22	159.63
1.0	0.625	0.750	5	5	19.73	53.60	116.44	1.2	0.625	0.625	7	5	23.26	74.63	150.84
1.0	0.625	0.750	6	5	19.46	53.03	115.13	1.2	0.625	0.625	6	6	23.03	76.37	157.82
1.0	0.625	0.750	5	6	19.25	53.03	115.13	1.2	0.625	0.625	7	6	22.77	67.10	140.71
1.0	0.625	0.750	6	6	18.98	41.00	91.70	1.2	0.625	0.750	6	5	21.85	45.68	103.16
1.0	0.750	0.625	5	5	16.93	82.84	164.91	1.2	0.625	0.750	7	5	21.70	45.10	96.75
1.0	0.750	0.625	6	5	16.54	80.82	160.85	1.2	0.625	0.750	6	6	21.48	45.36	102.38
1.0	0.750	0.625	5	6	16.28	80.82	160.85	1.2	0.625	0.750	7	6	21.35	39.08	91.21
1.0	0.750	0.625	6	6	15.91	65.11	130.60	1.2	0.750	0.625	6	5	18.29	72.74	146.27
1.0	0.750	0.750	5	5	15.00	51.18	105.96	1.2	0.750	0.625	7	5	17.92	68.30	135.54
1.0	0.750	0.750	6	5	14.74	50.31	104.12	1.2	0.750	0.625	6	6	17.79	71.57	143.86
1.0	0.750	0.750	5	6	14.53	50.31	104.12	1.2	0.750	0.625	7	6	17.45	64.19	130.12
1.0	0.750	0.750	6	6	14.27	39.63	83.51	1.2	0.750	0.625	6	5	16.42	44.28	93.84
1.0	0.875	0.500	6	6	16.15	100.65	196.34	1.2	0.750	0.750	6	5	16.20	42.56	87.47
1.0	0.875	0.625	5	5	14.13	75.60	148.89	1.2	0.750	0.750	7	5	16.06	43.81	92.78
1.0	0.875	0.625	6	5	13.79	73.25	144.24	1.2	0.750	0.750	6	6	15.86	38.52	83.20
1.0	0.875	0.625	5	6	13.52	73.25	144.24	1.2	0.875	0.500	7	6	17.32	102.05	199.49
1.0	0.875	0.625	6	6	13.17	60.31	119.36	1.2	0.875	0.625	6	5	15.12	67.39	133.57
1.0	0.875	0.750	5	5	12.19	48.16	97.22	1.2	0.875	0.625	7	5	14.72	61.47	122.45
1.0	0.875	0.750	6	6	11.93	47.02	94.90	1.2	0.875	0.625	6	6	14.66	65.97	130.72
1.0	0.875	0.750	5	5	11.74	47.02	94.90	1.2	0.875	0.625	7	6	14.29	60.21	119.93
1.0	0.875	0.750	6	6	11.49	37.75	77.08	1.2	0.875	0.625	6	5	13.21	42.26	86.59
1.0	1.000	0.500	6	5	14.67	100.82	195.95	1.2	0.875	0.750	6	5	12.96	39.62	79.62
1.0	1.000	0.500	5	6	14.49	100.82	195.95	1.2	0.875	0.750	7	6	12.86	41.61	85.22
1.0	1.000	0.500	6	6	14.06	87.65	170.55	1.2	0.875	0.750	6	6	12.63	37.21	77.17
1.0	1.000	0.625	5	5	12.23	68.04	133.20	1.2	1.000	0.500	6	5	16.02	96.86	188.50
1.0	1.000	0.625	6	5	11.87	65.63	128.46	1.2	1.000	0.500	7	5	15.49	92.05	179.35
1.0	1.000	0.625	5	6	11.68	65.63	128.46	1.2	1.000	0.500	6	6	15.52	94.26	183.42
1.0	1.000	0.625	6	6	11.35	55.15	108.32	1.2	1.000	0.500	6	6	15.52	94.26	183.42

PLATE AREA - 600.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.2	1.000	0.500	7	6	15.03	89.74	174.83	1.6	0.500	0.750	6	4	33.58	47.97	125.49
1.2	1.000	0.625	6	5	13.01	61.52	120.93	1.6	0.500	0.750	7	4	33.30	41.33	112.76
1.2	1.000	0.625	7	5	12.61	56.93	112.29	1.6	0.500	0.750	8	4	33.09	34.59	100.09
1.2	1.000	0.625	6	6	12.59	59.99	117.90	1.6	0.500	0.750	6	5	31.99	48.05	125.37
1.2	1.000	0.625	7	6	12.22	55.59	109.64	1.6	0.500	0.750	7	5	32.99	39.42	109.52
1.2	1.000	0.750	6	5	11.14	39.83	80.04	1.6	0.500	0.750	8	5	32.87	33.98	98.91
1.2	1.000	0.750	7	5	10.87	36.13	73.21	1.6	0.625	0.625	6	4	24.96	80.62	167.26
1.2	1.000	0.750	6	6	10.81	39.04	78.42	1.6	0.625	0.625	7	4	24.35	71.32	149.51
1.2	1.000	0.750	7	6	10.56	35.43	71.76	1.6	0.625	0.625	8	4	23.91	60.55	128.97
1.4	0.500	0.625	6	5	34.26	83.37	183.91	1.6	0.625	0.625	6	5	23.64	80.41	166.67
1.4	0.500	0.625	7	5	34.03	70.61	160.38	1.6	0.625	0.625	7	5	23.14	69.21	145.60
1.4	0.500	0.750	6	5	32.85	47.82	124.45	1.6	0.625	0.625	8	5	22.73	59.74	127.36
1.4	0.500	0.750	7	5	33.14	39.73	110.12	1.6	0.625	0.750	6	4	22.89	47.78	108.62
1.4	0.625	0.625	6	5	24.14	80.13	165.97	1.6	0.625	0.750	7	4	22.53	41.71	97.07
1.4	0.625	0.625	7	5	23.73	69.72	146.56	1.6	0.625	0.750	8	4	22.26	35.17	84.72
1.4	0.625	0.750	6	5	22.35	47.53	107.76	1.6	0.625	0.750	6	5	21.76	47.78	108.43
1.4	0.625	0.750	7	5	22.13	40.56	95.11	1.6	0.625	0.750	7	5	21.48	40.27	94.54
1.4	0.750	0.625	6	5	18.78	75.29	151.51	1.6	0.750	0.625	8	5	21.23	34.67	83.73
1.4	0.750	0.625	7	5	18.29	66.92	135.81	1.6	0.750	0.625	6	4	19.42	76.01	153.07
1.4	0.750	0.750	6	5	16.82	46.03	97.74	1.6	0.750	0.625	7	4	18.76	68.04	137.86
1.4	0.750	0.750	7	5	16.52	40.11	86.86	1.6	0.750	0.625	8	4	18.28	58.30	119.26
1.4	0.875	0.625	6	5	15.56	69.48	137.75	1.6	0.750	0.625	6	5	18.52	75.43	151.83
1.4	0.875	0.625	7	5	15.05	62.87	125.29	1.6	0.750	0.625	7	5	17.93	66.42	134.81
1.4	0.875	0.750	6	5	13.55	43.83	89.88	1.6	0.750	0.625	8	5	17.47	57.53	117.74
1.4	0.875	0.750	7	5	13.21	38.86	80.67	1.6	0.750	0.750	6	4	17.24	46.40	98.66
1.4	1.000	0.500	6	5	16.59	98.47	191.62	1.6	0.750	0.750	7	4	16.83	40.95	88.32
1.4	1.000	0.500	7	5	15.93	93.10	181.37	1.6	0.750	0.750	8	4	16.52	34.77	76.60
1.4	1.000	0.625	6	5	13.42	63.14	124.12	1.6	0.750	0.750	6	5	16.46	46.25	98.22
1.4	1.000	0.625	7	5	12.91	58.04	114.48	1.6	0.750	0.750	7	5	16.10	39.86	86.32
1.4	1.000	0.750	6	5	11.45	41.17	82.77	1.6	0.875	0.500	8	5	15.81	34.33	75.72
1.4	1.000	0.750	7	5	11.10	37.05	75.09	1.6	0.875	0.500	8	4	18.15	94.49	185.04
1.6	0.500	0.625	6	4	35.45	83.58	185.04	1.6	0.875	0.625	6	5	17.53	93.00	182.12
1.6	0.500	0.625	7	4	34.95	73.04	164.83	1.6	0.875	0.625	7	4	16.11	70.28	139.36
1.6	0.500	0.625	8	4	34.57	61.55	143.01	1.6	0.875	0.625	8	4	15.45	63.68	126.78
1.6	0.500	0.625	6	5	33.36	83.70	184.98	1.6	0.875	0.625	6	5	15.44	69.42	137.62
1.6	0.500	0.625	7	5	33.05	70.06	159.46	1.6	0.875	0.625	7	5	14.83	62.31	124.17
1.6	0.500	0.625	8	5	32.70	60.56	141.08	1.6	0.875	0.625	8	5	14.36	54.37	108.93
1.6	0.500	0.625	6	4				1.6	0.875	0.750	6	4	13.92	44.31	90.92

PLATE AREA - 600.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	0.875	0.750	7	4	13.47	39.50	81.80	1.8	0.625	0.750	8	5	20.04	33.95	81.89
1.6	0.875	0.750	8	4	13.14	33.80	70.98	1.8	0.750	0.500	8	5	20.01	100.33	197.91
1.6	0.875	0.750	6	5	13.34	43.98	90.17	1.8	0.750	0.625	7	4	17.87	65.94	133.59
1.6	0.875	0.750	7	5	12.93	38.61	80.15	1.8	0.750	0.625	8	4	17.33	56.75	116.06
1.6	0.875	0.750	8	5	12.62	33.37	70.13	1.8	0.750	0.625	7	5	17.21	64.69	131.24
1.6	1.000	0.500	6	4	17.18	98.90	192.43	1.8	0.750	0.625	8	5	16.70	56.20	114.99
1.6	1.000	0.500	7	4	16.39	93.26	181.61	1.8	0.750	0.750	7	4	15.89	39.71	85.57
1.6	1.000	0.500	8	4	15.74	83.57	162.99	1.8	0.750	0.750	8	4	15.59	33.92	74.65
1.6	1.000	0.500	6	5	16.63	97.19	189.08	1.8	0.750	0.750	7	5	15.32	38.85	84.04
1.6	1.000	0.500	7	5	15.89	91.45	178.12	1.8	0.750	0.750	8	5	14.99	33.60	74.03
1.6	1.000	0.500	8	5	15.27	82.24	160.39	1.8	0.875	0.500	8	4	17.53	91.29	178.72
1.6	1.000	0.625	6	4	13.90	63.85	125.51	1.8	0.875	0.500	7	5	17.80	101.45	198.26
1.6	1.000	0.625	7	4	13.27	58.60	115.51	1.8	0.875	0.500	8	5	17.04	90.20	176.62
1.6	1.000	0.625	8	4	12.77	51.34	101.61	1.8	0.875	0.625	7	4	14.82	61.68	122.75
1.6	1.000	0.625	6	5	13.38	62.86	123.54	1.8	0.875	0.625	8	4	14.28	53.58	107.28
1.6	1.000	0.625	7	5	12.80	57.39	113.19	1.8	0.875	0.625	7	5	14.35	60.63	120.77
1.6	1.000	0.625	8	5	12.33	50.55	100.07	1.8	0.875	0.625	8	5	13.82	53.02	106.19
1.6	1.000	0.750	6	4	11.79	41.70	83.84	1.8	0.875	0.750	7	4	12.81	38.33	79.32
1.6	1.000	0.750	7	4	11.34	37.56	75.99	1.8	0.875	0.750	8	4	12.44	32.94	69.12
1.6	1.000	0.750	8	4	10.99	32.42	66.23	1.8	0.875	0.750	7	5	12.39	37.64	78.05
1.6	1.000	0.750	6	5	11.34	41.22	82.84	1.8	0.875	0.750	8	5	12.04	32.64	68.52
1.6	1.000	0.750	7	5	10.91	36.78	74.52	1.8	1.000	0.500	7	4	15.97	89.60	174.46
1.6	1.000	0.750	8	5	10.58	31.99	65.36	1.8	1.000	0.500	8	4	15.28	80.44	156.85
1.6	0.500	0.625	7	4	32.79	70.49	159.28	1.8	1.000	0.500	7	5	15.58	88.25	171.84
1.8	0.500	0.625	8	4	32.38	59.98	139.47	1.8	1.000	0.500	8	5	14.92	79.47	154.95
1.8	0.500	0.625	7	5	31.26	68.17	155.18	1.8	1.000	0.625	7	4	12.82	56.65	111.62
1.8	0.500	0.625	8	5	30.87	59.26	138.09	1.8	1.000	0.625	8	4	12.29	49.74	98.41
1.8	0.500	0.750	7	4	31.26	39.84	108.78	1.8	1.000	0.625	7	5	12.45	55.74	109.87
1.8	0.500	0.750	8	4	31.82	33.73	97.54	1.8	1.000	0.625	8	5	11.94	49.18	97.30
1.8	0.500	0.750	7	5	31.75	38.36	106.36	1.8	1.000	0.750	7	4	10.85	36.43	73.66
1.8	0.500	0.750	8	5	31.89	33.28	96.72	1.8	1.000	0.750	8	4	10.47	31.55	64.39
1.8	0.625	0.625	7	4	23.00	69.05	144.77	1.8	1.000	0.750	7	5	10.53	35.84	72.54
1.8	0.625	0.625	8	4	22.52	59.01	125.69	1.8	1.000	0.750	8	5	10.16	31.24	63.78
1.8	0.625	0.625	7	5	22.05	67.40	141.76	2.0	0.500	0.625	7	4	30.45	67.54	152.56
1.8	0.625	0.625	8	5	21.58	58.42	124.54	2.0	0.500	0.625	8	4	30.02	57.96	134.68
1.8	0.625	0.750	7	4	21.14	40.34	93.88	2.0	0.500	0.625	9	4	29.69	50.60	120.16
1.8	0.625	0.750	8	4	20.85	34.31	82.58	2.0	0.500	0.750	7	4	29.53	38.15	103.91
1.8	0.625	0.750	7	5	20.32	39.22	91.94	2.0	0.500	0.750	8	4	30.29	32.63	94.01

PLATE AREA - 600.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
2.0	0.500	0.750	9	4	29.79	28.13	84.72	4.0	0.500	0.375	14	4	21.07	97.23	193.45
2.0	0.625	0.500	9	4	23.64	95.12	191.08	4.0	0.500	0.375	15	4	20.65	91.19	181.82
2.0	0.625	0.625	7	4	21.54	66.31	138.94	4.0	0.500	0.375	16	4	20.29	85.78	171.43
2.0	0.625	0.625	8	4	21.03	57.01	121.33	4.0	0.500	0.500	9	3	17.68	69.50	143.51
2.0	0.625	0.625	9	4	20.63	50.40	108.54	4.0	0.500	0.500	10	3	17.23	62.22	129.68
2.0	0.625	0.750	7	4	19.64	38.73	89.94	4.0	0.500	0.500	11	3	16.86	56.51	118.70
2.0	0.625	0.750	8	4	19.33	33.19	79.68	4.0	0.500	0.500	12	3	16.56	59.66	115.57
2.0	0.625	0.750	9	4	19.10	28.99	71.42	4.0	0.500	0.625	9	3	15.36	36.43	83.96
2.0	0.750	0.500	8	4	19.70	97.49	192.23	4.0	0.500	0.625	10	3	15.79	39.59	76.81
2.0	0.750	0.500	9	4	18.99	88.66	175.24	4.0	0.500	0.625	11	3	15.72	38.90	75.47
2.0	0.750	0.625	7	4	16.88	63.35	128.27	4.0	0.500	0.625	12	3	15.99	38.33	74.36
2.0	0.750	0.625	8	4	16.32	54.76	111.92	4.0	0.500	0.750	9	3	15.95	20.81	57.45
2.0	0.750	0.625	9	4	15.88	48.97	100.78	4.0	0.500	0.750	10	3	16.37	18.53	53.46
2.0	0.750	0.750	7	4	14.87	38.17	82.13	4.0	0.500	0.750	11	3	16.10	25.56	49.81
2.0	0.750	0.750	8	4	14.51	32.80	72.09	4.0	0.500	0.750	12	3	16.35	25.28	49.26
2.0	0.750	0.750	9	4	14.24	28.96	64.64	4.0	0.625	0.375	12	3	17.77	99.32	194.38
2.0	0.875	0.500	7	4	17.62	98.49	192.37	4.0	0.625	0.375	13	3	17.23	93.55	183.29
2.0	0.875	0.500	8	4	16.81	87.42	171.11	4.0	0.625	0.375	14	3	16.76	87.67	171.98
2.0	0.875	0.500	9	4	16.14	80.57	157.95	4.0	0.625	0.375	15	3	16.34	83.11	163.23
2.0	0.875	0.625	7	4	14.12	59.20	117.74	4.0	0.625	0.375	16	3	15.96	78.47	154.29
2.0	0.875	0.625	8	4	13.55	51.60	103.25	4.0	0.625	0.375	12	4	17.97	98.83	193.41
2.0	0.875	0.625	9	4	13.09	46.64	93.79	4.0	0.625	0.375	13	4	17.43	92.84	181.88
2.0	0.875	0.750	7	4	12.08	36.87	76.19	4.0	0.625	0.375	14	4	16.95	87.17	170.98
2.0	0.875	0.750	8	4	11.70	31.82	66.67	4.0	0.625	0.375	15	4	16.52	82.48	161.96
2.0	0.875	0.750	9	4	11.40	28.38	60.06	4.0	0.625	0.375	16	4	16.14	77.98	153.31
2.0	1.000	0.375	12	4	17.03	99.44	193.11	4.0	0.625	0.500	9	3	14.22	64.61	129.02
2.0	1.000	0.375	12	5	16.82	98.75	191.77	4.0	0.625	0.500	10	3	13.71	58.18	116.76
2.0	1.000	0.375	12	6	16.70	98.17	190.64	4.0	0.625	0.500	11	3	13.30	53.45	107.69
2.0	1.000	0.500	7	4	15.43	85.28	165.99	4.0	0.625	0.500	12	3	12.95	49.00	99.20
2.0	1.000	0.500	8	4	14.73	76.74	149.59	4.0	0.625	0.625	9	3	11.32	35.68	75.44
2.0	1.000	0.500	9	4	14.13	71.67	139.83	4.0	0.625	0.625	10	3	11.04	31.91	68.33
2.0	1.000	0.625	7	4	12.29	54.27	106.85	4.0	0.625	0.625	11	3	10.80	28.99	62.74
2.0	1.000	0.625	8	4	11.74	47.78	94.46	4.0	0.625	0.625	12	3	10.61	26.44	57.94
2.0	1.000	0.625	9	4	11.29	43.66	86.58	4.0	0.625	0.750	10	3	10.10	18.85	45.23
2.0	1.000	0.750	7	4	10.31	35.02	70.72	4.0	0.625	0.750	11	3	10.08	16.97	41.57
								4.0	0.625	0.750	12	3	10.27	20.46	39.64
4.0	0.500	0.375	14	3	20.60	98.17	195.37	4.0	0.750	0.375	9	3	17.05	101.19	196.56
4.0	0.500	0.375	15	3	20.19	92.38	184.23	4.0	0.750	0.375	10	3	16.38	94.11	182.93
4.0	0.500	0.375	16	3	19.83	89.65	173.64	4.0	0.750	0.375	11	3	15.78	89.11	173.33

PLATE AREA - 600.0000

MAXIMUM STRESSES															MAXIMUM STRESSES				
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL				
4.0	0.750	0.375	12	3	15.26	83.67	162.86	4.0	1.000	0.375	12	3	11.49	55.10	106.79				
4.0	0.750	0.375	13	3	14.79	79.61	155.06	4.0	1.000	0.375	13	3	11.21	53.41	103.54				
4.0	0.750	0.375	14	3	14.37	75.29	146.75	4.0	1.000	0.375	14	3	10.95	51.39	99.65				
4.0	0.750	0.375	15	3	13.99	71.95	140.33	4.0	1.000	0.375	15	3	10.71	49.87	96.73				
4.0	0.750	0.375	16	3	13.64	68.43	133.56	4.0	1.000	0.375	16	3	10.48	48.12	93.38				
4.0	0.750	0.375	9	4	17.14	100.70	195.60	4.0	1.000	0.375	9	4	12.48	62.10	120.25				
4.0	0.750	0.375	10	4	16.47	93.87	182.46	4.0	1.000	0.375	10	4	12.13	59.26	114.79				
4.0	0.750	0.375	11	4	15.88	88.68	172.49	4.0	1.000	0.375	11	4	11.81	57.36	111.13				
4.0	0.750	0.375	12	4	15.35	83.40	162.33	4.0	1.000	0.375	12	4	11.91	55.01	106.61				
4.0	0.750	0.375	13	4	14.88	79.23	154.31	4.0	1.000	0.375	13	4	11.23	53.29	103.30				
4.0	0.750	0.375	14	4	14.46	75.02	146.21	4.0	1.000	0.375	14	4	10.97	51.29	99.47				
4.0	0.750	0.375	15	4	14.08	71.60	139.64	4.0	1.000	0.375	15	4	10.73	49.75	96.50				
4.0	0.750	0.375	16	4	13.73	68.16	133.03	4.0	1.000	0.375	16	4	10.51	48.03	93.20				
4.0	0.750	0.500	9	3	12.22	57.83	113.75												
4.0	0.750	0.500	10	3	11.72	52.59	103.73												
4.0	0.750	0.500	11	3	11.30	48.80	96.50												
4.0	0.750	0.500	12	3	10.93	45.05	89.33												
4.0	0.875	0.375	9	3	14.59	79.81	154.72												
4.0	0.875	0.375	10	3	14.10	75.24	145.92												
4.0	0.875	0.375	11	3	13.65	72.13	139.95												
4.0	0.875	0.375	12	3	13.24	68.47	132.92												
4.0	0.875	0.375	13	3	12.87	65.80	127.78												
4.0	0.875	0.375	14	3	12.53	62.79	121.99												
4.0	0.875	0.375	15	3	12.22	60.49	117.56												
4.0	0.875	0.375	16	3	11.93	57.97	112.71												
4.0	0.875	0.375	9	4	14.64	79.55	154.20												
4.0	0.875	0.375	10	4	14.14	75.10	145.65												
4.0	0.875	0.375	11	4	13.69	71.90	139.49												
4.0	0.875	0.375	12	4	13.29	68.32	132.62												
4.0	0.875	0.375	13	4	12.91	65.59	127.36												
4.0	0.875	0.375	14	4	12.57	62.64	121.69												
4.0	0.875	0.375	15	4	12.26	60.29	117.18												
4.0	0.875	0.375	16	4	11.97	57.81	112.41												
4.0	0.875	0.500	9	3	10.79	50.25	98.08												
4.0	0.875	0.500	10	3	10.34	46.21	90.36												
4.0	1.000	0.375	9	3	12.45	62.25	120.54												
4.0	1.000	0.375	10	3	12.11	59.35	114.95												
4.0	1.000	0.375	11	3	11.78	57.49	111.39												

PLATE AREA - 650.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.625	6	6	31.46	81.74	176.49	1.2	0.500	0.625	6	6	35.63	90.13	196.16
1.0	0.500	0.750	5	5	31.02	62.17	147.51	1.2	0.500	0.625	7	6	35.53	77.15	172.49
1.0	0.500	0.750	6	5	30.71	61.80	146.55	1.2	0.500	0.750	6	5	34.74	52.05	131.99
1.0	0.500	0.750	5	6	30.49	61.80	146.55	1.2	0.500	0.750	7	5	34.70	52.95	122.93
1.0	0.500	0.750	6	6	30.18	46.95	116.98	1.2	0.500	0.750	6	6	34.33	51.84	131.36
1.0	0.625	0.625	6	6	22.16	78.29	160.43	1.2	0.500	0.750	7	6	34.33	43.49	116.96
1.0	0.625	0.750	5	5	21.35	60.61	130.65	1.2	0.625	0.625	6	5	25.50	87.23	179.52
1.0	0.625	0.750	6	5	21.06	59.97	129.20	1.2	0.625	0.625	7	5	25.19	84.40	170.05
1.0	0.625	0.750	5	6	20.83	59.97	129.20	1.2	0.625	0.625	6	6	24.94	86.27	177.48
1.0	0.625	0.750	6	6	20.53	46.39	102.74	1.2	0.625	0.625	7	6	24.65	75.79	158.05
1.0	0.750	0.625	5	5	18.34	93.57	185.93	1.2	0.625	0.750	6	5	23.64	51.65	115.46
1.0	0.750	0.625	6	5	17.92	91.30	181.38	1.2	0.625	0.750	7	5	23.48	51.06	108.76
1.0	0.750	0.625	5	6	17.63	91.30	181.38	1.2	0.625	0.750	6	6	23.23	51.29	114.59
1.0	0.750	0.625	6	6	17.23	73.56	147.18	1.2	0.625	0.750	7	6	23.10	44.17	101.86
1.0	0.750	0.750	5	5	16.24	57.84	119.22	1.2	0.750	0.625	6	5	19.81	82.15	164.75
1.0	0.750	0.750	6	5	15.95	56.87	117.17	1.2	0.750	0.625	7	5	19.41	77.21	152.96
1.0	0.750	0.750	5	6	15.73	56.87	117.17	1.2	0.750	0.625	6	6	19.27	80.82	162.03
1.0	0.750	0.750	6	6	15.44	44.81	93.87	1.2	0.750	0.625	7	6	18.90	72.49	146.47
1.0	0.875	0.625	5	5	15.31	85.38	167.97	1.2	0.750	0.750	6	5	17.77	50.03	105.39
1.0	0.875	0.625	6	5	14.90	82.73	162.74	1.2	0.750	0.750	7	5	17.54	48.16	98.56
1.0	0.875	0.625	5	6	14.65	82.73	162.74	1.2	0.750	0.750	6	6	17.38	49.50	104.20
1.0	0.875	0.625	6	6	14.26	68.11	134.61	1.2	0.750	0.750	7	6	17.17	43.51	93.31
1.0	0.875	0.750	5	5	13.20	54.42	109.55	1.2	0.875	0.625	6	5	16.38	76.09	150.57
1.0	0.875	0.750	6	5	12.92	53.14	106.95	1.2	0.875	0.625	7	5	15.95	69.40	137.99
1.0	0.875	0.750	5	6	12.71	53.14	106.95	1.2	0.875	0.625	6	6	15.88	74.48	147.36
1.0	0.875	0.750	6	6	12.44	42.66	86.80	1.2	0.875	0.625	7	6	15.48	67.98	135.15
1.0	1.000	0.500	6	6	15.24	98.93	192.44	1.2	0.875	0.750	6	5	14.30	47.73	97.43
1.0	1.000	0.625	5	5	13.25	76.83	150.31	1.2	0.875	0.750	7	5	14.03	44.82	89.83
1.0	1.000	0.625	6	5	12.86	74.12	144.98	1.2	0.875	0.750	6	6	13.93	47.00	95.90
1.0	1.000	0.625	5	6	12.66	74.12	144.98	1.2	0.875	0.750	7	6	13.67	42.03	86.76
1.0	1.000	0.625	6	6	12.29	62.28	122.20	1.2	1.000	0.500	7	6	16.28	101.29	197.26
1.0	1.000	0.750	5	5	11.23	50.61	100.53	1.2	1.000	0.625	6	5	14.09	69.44	136.37
1.0	1.000	0.750	6	5	10.96	49.12	97.54	1.2	1.000	0.625	7	5	13.66	64.27	126.62
1.0	1.000	0.750	5	6	10.77	49.12	97.54	1.2	1.000	0.625	6	6	13.64	67.72	132.97
1.0	1.000	0.750	6	6	10.50	40.17	80.37	1.2	1.000	0.625	7	6	13.24	62.77	123.64
1.2	0.500	0.625	6	5	36.22	90.75	197.59	1.2	1.000	0.750	6	5	12.06	44.97	90.15
1.2	0.500	0.625	7	5	36.08	90.55	189.39	1.2	1.000	0.750	7	5	11.77	40.80	82.42
													11.71	44.08	88.34

PLATE AREA - 650.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.2	1.000	0.750	7	6	11.44	40.01	80.80	1.6	0.625	0.625	8	5	24.61	67.46	142.90
1.4	0.500	0.625	7	5	36.84	79.76	179.26	1.6	0.625	0.750	6	4	24.83	53.97	121.49
1.4	0.500	0.625	8	5	36.54	77.29	160.03	1.6	0.625	0.750	7	4	24.43	47.15	108.50
1.4	0.500	0.750	6	5	35.53	54.13	138.34	1.6	0.625	0.750	8	4	24.15	39.76	94.51
1.4	0.500	0.750	7	5	35.44	44.94	121.97	1.6	0.625	0.750	6	5	23.55	53.98	121.30
1.4	0.625	0.625	6	5	26.13	90.49	186.58	1.6	0.625	0.750	7	5	23.26	45.49	103.53
1.4	0.625	0.625	7	5	25.70	78.71	164.55	1.6	0.625	0.750	8	5	22.99	39.19	93.37
1.4	0.625	0.625	8	5	25.32	67.73	143.33	1.6	0.750	0.625	7	5	19.42	74.96	151.67
1.4	0.625	0.750	6	5	24.19	53.72	120.56	1.6	0.750	0.625	8	5	18.92	64.94	132.42
1.4	0.625	0.750	7	5	23.96	45.81	106.15	1.6	0.750	0.750	6	4	18.70	52.39	110.73
1.4	0.750	0.625	6	5	20.34	85.00	170.60	1.6	0.750	0.750	7	4	18.25	46.26	99.08
1.4	0.750	0.625	7	5	19.81	75.54	152.82	1.6	0.750	0.750	8	4	17.92	39.27	85.82
1.4	0.750	0.625	8	5	19.39	65.31	133.11	1.6	0.750	0.750	6	5	17.82	52.22	110.25
1.4	0.750	0.750	6	5	18.20	51.99	109.72	1.6	0.750	0.750	7	5	17.43	44.99	96.77
1.4	0.750	0.750	7	5	17.88	45.29	97.37	1.6	0.875	0.625	8	5	17.12	38.77	84.82
1.4	0.875	0.625	6	5	16.86	78.43	155.24	1.6	0.875	0.625	7	5	16.07	70.32	139.86
1.4	0.875	0.625	7	5	16.30	70.96	141.15	1.6	0.875	0.750	8	5	15.55	61.37	122.67
1.4	0.875	0.625	8	5	15.86	61.85	123.63	1.6	0.875	0.750	6	4	15.10	50.00	102.23
1.4	0.875	0.750	6	5	14.68	49.48	101.10	1.6	0.875	0.750	7	4	14.61	44.60	91.97
1.4	0.875	0.750	7	5	14.31	43.86	90.66	1.6	0.875	0.750	8	4	14.25	38.16	79.73
1.4	1.000	0.500	8	5	16.67	94.45	184.15	1.6	0.875	0.750	6	5	14.45	49.64	101.41
1.4	1.000	0.500	8	6	16.30	92.77	180.87	1.6	0.875	0.750	7	5	14.01	43.58	90.06
1.4	1.000	0.625	6	5	14.54	71.26	139.95	1.6	1.000	0.500	8	5	13.67	37.68	78.76
1.4	1.000	0.625	7	5	13.99	65.50	129.05	1.6	1.000	0.625	7	5	16.55	92.79	180.90
1.4	1.000	0.625	8	5	13.55	57.66	113.99	1.6	1.000	0.625	8	5	13.86	64.77	127.58
1.4	1.000	0.750	6	5	12.41	46.47	93.20	1.6	1.000	0.750	6	4	12.79	57.05	112.77
1.4	1.000	0.750	7	5	12.02	41.82	84.51	1.6	1.000	0.750	7	4	12.29	47.05	94.38
1.6	0.500	0.625	7	5	35.79	79.13	178.22	1.6	1.000	0.750	8	4	11.91	36.59	74.50
1.6	0.500	0.625	8	5	35.41	68.45	157.55	1.6	1.000	0.750	6	5	12.28	46.52	93.27
1.6	0.500	0.750	6	4	36.42	54.27	139.47	1.6	1.000	0.750	7	5	11.82	41.51	83.86
1.6	0.500	0.750	7	4	36.11	46.81	125.15	1.6	1.000	0.750	8	5	11.47	36.10	73.52
1.6	0.500	0.750	8	4	35.89	39.20	110.82	1.8	0.500	0.625	7	4	35.56	79.66	178.19
1.6	0.500	0.750	6	5	34.45	54.38	139.37	1.8	0.500	0.625	8	4	35.12	67.80	155.80
1.6	0.500	0.750	7	5	34.89	44.59	121.35	1.8	0.500	0.625	9	4	34.78	59.77	140.14
1.6	0.500	0.750	8	5	34.77	38.49	109.45	1.8	0.500	0.625	7	5	33.86	76.99	173.44
1.6	0.625	0.625	7	5	25.07	78.12	163.45	1.8	0.500	0.625	8	5	33.44	66.97	154.22

PLATE AREA - 650.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.8	0.500	0.625	9	5	33.12	57.82	136.71	1.8	1.000	0.500	7	4	17.31	101.09	196.77
1.8	0.500	0.750	7	4	33.74	45.10	120.76	1.8	1.000	0.500	8	4	16.56	90.76	176.88
1.8	0.500	0.750	8	4	33.74	38.22	108.04	1.8	1.000	0.500	9	4	15.93	84.93	165.69
1.8	0.500	0.750	7	5	33.66	43.38	117.91	1.8	1.000	0.500	7	5	16.88	99.56	193.81
1.8	0.500	0.750	8	5	33.81	37.69	107.09	1.8	1.000	0.500	8	5	16.17	89.66	174.75
1.8	0.625	0.625	7	4	24.95	77.97	162.61	1.8	1.000	0.500	9	5	15.56	83.78	163.48
1.8	0.625	0.625	8	4	24.42	66.64	141.04	1.8	1.000	0.625	7	4	13.90	63.92	125.81
1.8	0.625	0.625	9	4	24.02	59.36	127.02	1.8	1.000	0.625	8	4	13.32	56.13	110.89
1.8	0.625	0.625	7	5	23.89	76.06	159.12	1.8	1.000	0.625	9	4	12.85	51.47	101.97
1.8	0.625	0.625	8	5	23.38	65.96	139.73	1.8	1.000	0.625	7	5	13.49	62.89	123.83
1.8	0.625	0.625	9	5	22.99	57.92	124.40	1.8	1.000	0.625	8	5	12.94	55.49	109.64
1.8	0.625	0.750	7	4	22.93	45.59	104.93	1.8	1.000	0.625	9	5	12.49	50.71	100.53
1.8	0.625	0.750	8	4	22.62	38.79	92.15	1.8	1.000	0.750	7	4	11.76	41.12	82.91
1.8	0.625	0.750	7	5	22.01	44.29	102.65	1.8	1.000	0.750	8	4	11.35	35.60	72.43
1.8	0.625	0.750	8	5	21.70	38.36	91.35	1.8	1.000	0.750	7	5	11.40	40.44	81.63
1.8	0.750	0.625	7	4	19.37	74.43	150.34	1.8	1.000	0.750	8	5	11.01	35.25	71.73
1.8	0.750	0.625	8	4	18.79	64.05	130.53								
1.8	0.750	0.625	9	4	18.34	57.62	118.17	2.0	0.500	0.625	7	4	33.03	76.30	170.67
1.8	0.750	0.625	7	5	18.65	72.99	147.64	2.0	0.500	0.625	8	4	32.56	65.50	150.46
1.8	0.750	0.625	8	5	18.09	63.43	129.31	2.0	0.500	0.625	9	4	32.21	57.20	134.10
1.8	0.750	0.625	9	5	17.66	56.52	116.14	2.0	0.500	0.625	7	5	31.64	74.14	166.89
1.8	0.750	0.750	7	4	17.23	44.84	95.99	2.0	0.500	0.625	8	5	31.18	64.87	149.30
1.8	0.750	0.750	8	4	16.87	38.30	83.65	2.0	0.500	0.625	9	5	30.83	55.64	131.42
1.8	0.750	0.750	7	5	16.59	43.84	94.21	2.0	0.500	0.750	7	4	31.37	43.18	115.38
1.8	0.750	0.750	8	5	16.24	37.94	82.94	2.0	0.500	0.750	8	4	32.19	36.96	104.18
1.8	0.875	0.500	9	4	18.30	95.21	186.55	2.0	0.500	0.750	9	4	31.66	31.88	93.75
1.8	0.875	0.500	8	5	18.46	101.78	199.14	2.0	0.625	0.625	7	4	23.36	74.85	156.04
1.8	0.875	0.500	9	5	17.79	93.82	183.89	2.0	0.625	0.625	8	4	22.81	64.36	136.16
1.8	0.875	0.625	7	4	16.07	69.60	138.28	2.0	0.625	0.625	9	4	22.38	56.91	121.73
1.8	0.875	0.625	8	4	15.48	60.46	120.80	2.0	0.625	0.625	7	5	22.50	73.30	153.24
1.8	0.875	0.625	9	4	15.01	54.90	110.15	2.0	0.625	0.625	8	5	21.96	63.86	135.20
1.8	0.875	0.625	7	5	15.54	68.41	136.02	2.0	0.625	0.625	9	5	21.54	55.75	119.65
1.8	0.875	0.625	8	5	14.97	59.83	119.56	2.0	0.625	0.750	7	4	21.31	43.75	100.53
1.8	0.875	0.625	9	5	14.52	54.02	108.48	2.0	0.625	0.750	8	4	20.98	37.51	88.94
1.8	0.875	0.750	7	4	13.89	43.27	89.17	2.0	0.625	0.750	9	4	20.72	32.78	79.63
1.8	0.875	0.750	8	4	13.50	37.18	77.63	2.0	0.750	0.500	9	4	20.59	100.03	197.47
1.8	0.875	0.750	7	5	13.42	42.47	87.70	2.0	0.750	0.500	9	5	20.01	98.73	194.99
1.8	0.875	0.750	8	5	13.04	36.84	76.95	2.0	0.750	0.625	7	4	18.30	71.49	144.33

PLATE AREA - 650.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
2.0	0.750	0.625	8	4	17.70	61.80	125.86	4.0	0.500	0.375	17	3	21.14	99.47	192.70
2.0	0.750	0.625	9	4	17.22	55.27	113.30	4.0	0.500	0.375	16	4	21.99	96.73	192.92
2.0	0.750	0.625	7	5	17.72	70.34	142.19	4.0	0.500	0.375	17	4	21.63	91.41	182.67
2.0	0.750	0.625	8	5	17.13	61.35	124.99	4.0	0.500	0.500	10	3	18.66	70.15	145.57
2.0	0.750	0.625	9	5	16.67	54.40	111.70	4.0	0.500	0.500	11	3	18.27	68.97	133.62
2.0	0.750	0.750	7	4	16.13	43.09	92.14	4.0	0.500	0.500	12	3	17.94	67.53	130.82
2.0	0.750	0.750	8	4	15.75	37.03	80.74	4.0	0.500	0.500	13	3	17.67	66.30	128.43
2.0	0.750	0.750	9	4	15.45	32.71	72.38	4.0	0.500	0.625	10	3	16.92	44.91	87.14
2.0	0.875	0.500	8	4	18.22	98.63	192.92	4.0	0.500	0.625	11	3	16.85	44.15	85.65
2.0	0.875	0.500	9	4	17.50	90.91	178.07	4.0	0.500	0.625	12	3	17.14	43.52	84.42
2.0	0.875	0.500	8	5	17.79	97.74	191.19	4.0	0.500	0.625	13	3	17.10	42.98	83.38
2.0	0.875	0.500	9	5	17.09	89.85	176.05	4.0	0.500	0.750	10	3	17.81	20.91	59.45
2.0	0.875	0.625	7	4	15.31	66.79	132.63	4.0	0.500	0.750	11	3	17.52	29.12	56.73
2.0	0.875	0.625	8	4	14.69	58.22	116.25	4.0	0.500	0.750	12	3	17.80	28.81	56.12
2.0	0.875	0.625	9	4	14.20	52.63	105.54	4.0	0.500	0.750	13	3	17.59	28.54	55.60
2.0	0.875	0.625	7	5	14.89	65.86	130.87	4.0	0.625	0.375	14	3	18.15	98.85	193.76
2.0	0.875	0.625	8	5	14.29	57.76	115.37	4.0	0.625	0.375	15	3	17.70	93.72	183.89
2.0	0.875	0.625	9	5	13.81	51.94	104.25	4.0	0.625	0.375	16	3	17.29	88.48	173.80
2.0	0.875	0.750	7	4	13.10	41.60	85.64	4.0	0.625	0.375	17	3	16.92	84.32	165.81
2.0	0.875	0.750	8	4	12.69	35.91	74.88	4.0	0.625	0.375	14	4	18.36	98.29	192.65
2.0	0.875	0.750	9	4	12.36	32.03	67.44	4.0	0.625	0.375	15	4	17.90	93.00	182.46
2.0	1.000	0.500	7	4	16.72	96.21	187.21	4.0	0.625	0.375	16	4	17.49	87.93	172.71
2.0	1.000	0.500	8	4	15.96	86.57	168.69	4.0	0.625	0.375	17	4	17.12	83.67	164.52
2.0	1.000	0.500	9	4	15.32	80.85	157.68	4.0	0.625	0.500	10	3	14.86	65.59	131.34
2.0	1.000	0.500	7	5	16.38	95.04	184.97	4.0	0.625	0.500	11	3	14.40	60.24	121.11
2.0	1.000	0.500	8	5	15.65	85.77	167.12	4.0	0.625	0.500	12	3	14.02	55.23	111.53
2.0	1.000	0.500	9	5	15.02	79.98	156.02	4.0	0.625	0.500	13	3	13.70	51.39	104.17
2.0	1.000	0.625	7	4	13.32	61.22	120.43	4.0	0.625	0.625	10	3	11.95	35.96	76.62
2.0	1.000	0.625	8	4	12.72	53.90	106.44	4.0	0.625	0.625	11	3	11.70	32.67	70.31
2.0	1.000	0.625	9	4	12.24	49.26	97.55	4.0	0.625	0.625	12	3	11.49	33.72	65.27
2.0	1.000	0.625	7	5	13.00	60.42	118.90	4.0	0.625	0.625	13	3	11.31	33.06	63.99
2.0	1.000	0.625	8	5	12.42	53.44	105.54	4.0	0.625	0.750	10	3	10.99	21.24	50.54
2.0	1.000	0.625	9	5	11.95	48.68	96.44	4.0	0.625	0.750	11	3	10.97	19.11	46.41
2.0	1.000	0.750	7	4	11.18	39.51	79.59	4.0	0.625	0.750	12	3	11.16	23.28	45.12
2.0	1.000	0.750	8	4	10.75	34.33	69.77	4.0	0.750	0.375	11	3	11.15	22.93	44.44
2.0	1.000	0.750	9	4	10.41	30.91	63.22	4.0	0.750	0.375	12	3	17.10	100.48	195.40
4.0	0.500	0.375	16	3	21.48	101.27	196.18	4.0	0.750	0.375	13	3	16.53	94.34	183.59
								4.0	0.750	0.375			16.02	89.77	174.80

PLATE AREA - 650.0000

MAXIMUM STRESSES															MAXIMUM STRESSES				
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL				
4.0	0.750	0.375	14	3	15.57	84.89	165.42	4.0	1.000	0.375	13	3	12.14	60.23	116.77				
4.0	0.750	0.375	15	3	15.15	81.12	158.17	4.0	1.000	0.375	14	3	11.86	57.94	112.37				
4.0	0.750	0.375	16	3	14.78	77.16	150.53	4.0	1.000	0.375	15	3	11.60	56.23	109.08				
4.0	0.750	0.375	17	3	14.44	74.00	144.47	4.0	1.000	0.375	16	3	11.36	54.27	105.29				
4.0	0.750	0.375	11	4	17.20	100.00	194.46	4.0	1.000	0.375	17	3	11.13	52.73	102.34				
4.0	0.750	0.375	12	4	16.63	94.04	183.00	4.0	1.000	0.375	10	4	13.14	66.83	129.46				
4.0	0.750	0.375	13	4	16.12	89.34	173.95	4.0	1.000	0.375	11	4	12.79	64.68	125.33				
4.0	0.750	0.375	14	4	15.66	84.59	164.81	4.0	1.000	0.375	12	4	12.47	62.03	120.22				
4.0	0.750	0.375	15	4	15.25	80.74	157.40	4.0	1.000	0.375	13	4	12.17	60.09	116.49				
4.0	0.750	0.375	16	4	14.87	76.86	149.93	4.0	1.000	0.375	14	4	11.89	57.84	112.16				
4.0	0.750	0.375	17	4	14.53	73.65	143.76	4.0	1.000	0.375	15	4	11.63	56.10	108.82				
4.0	0.750	0.500	10	3	12.69	59.27	116.81	4.0	1.000	0.375	16	4	11.38	54.16	105.09				
4.0	0.750	0.500	11	3	12.23	55.00	108.65	4.0	1.000	0.375	17	4	11.15	52.61	102.11				
4.0	0.750	0.500	12	3	11.84	50.78	100.56												
4.0	0.750	0.500	13	3	11.51	47.59	94.46												
4.0	0.875	0.375	10	3	15.27	84.84	164.55												
4.0	0.875	0.375	11	3	14.78	81.34	157.81												
4.0	0.875	0.375	12	3	14.34	77.21	149.87												
4.0	0.875	0.375	13	3	13.94	74.20	144.07												
4.0	0.875	0.375	14	3	13.57	70.80	137.54												
4.0	0.875	0.375	15	3	13.23	68.21	132.55												
4.0	0.875	0.375	16	3	12.92	65.36	127.07												
4.0	0.875	0.375	17	3	12.63	63.11	122.74												
4.0	0.875	0.375	10	4	15.32	84.68	164.24												
4.0	0.875	0.375	11	4	14.83	81.07	157.29												
4.0	0.875	0.375	12	4	14.39	77.04	149.53												
4.0	0.875	0.375	13	4	13.99	73.96	143.60												
4.0	0.875	0.375	14	4	13.62	70.63	137.20												
4.0	0.875	0.375	15	4	13.28	67.99	132.12												
4.0	0.875	0.375	16	4	12.97	65.19	126.74												
4.0	0.875	0.375	17	4	12.68	62.91	122.35												
4.0	0.875	0.500	10	3	11.20	52.09	101.82												
4.0	0.875	0.500	11	3	10.78	48.83	95.59												
4.0	0.875	0.500	12	3	10.41	45.46	89.13												
4.0	0.875	0.500	13	3	10.09	42.92	84.26												
4.0	1.000	0.375	10	3	13.11	66.92	129.64												
4.0	1.000	0.375	11	3	12.77	64.83	125.63												
4.0	1.000	0.375	12	3	12.44	62.13	120.43												

PLATE AREA - 700.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.625	6	6	33.84	91.60	196.37	1.0	1.000	0.750	6	7	10.97	43.99	87.81
1.0	0.500	0.625	7	6	33.83	90.82	194.64	1.0	1.000	0.750	7	7	10.80	40.31	81.03
1.0	0.500	0.625	6	7	33.60	90.82	194.64								
1.0	0.500	0.625	7	7	33.54	79.07	173.33	1.2	0.500	0.625	7	6	38.24	86.40	191.41
1.0	0.500	0.750	6	6	32.45	52.70	129.29	1.2	0.500	0.750	6	5	37.35	58.41	145.72
1.0	0.500	0.750	7	6	32.51	52.37	128.46	1.2	0.500	0.750	7	5	37.33	59.44	136.42
1.0	0.500	0.750	6	7	32.34	52.37	128.46	1.2	0.500	0.750	6	6	36.91	58.15	145.02
1.0	0.500	0.750	7	7	32.35	44.80	115.61	1.2	0.500	0.750	7	6	36.93	48.78	128.71
1.0	0.625	0.625	6	6	23.85	87.67	178.99	1.2	0.625	0.625	7	5	27.11	94.56	190.03
1.0	0.625	0.625	7	6	23.68	86.58	176.70	1.2	0.625	0.625	6	6	26.84	96.57	197.89
1.0	0.625	0.625	6	7	23.44	86.58	176.70	1.2	0.625	0.625	7	6	26.54	84.83	176.07
1.0	0.625	0.625	7	7	23.27	77.04	159.07	1.2	0.625	0.750	6	5	25.43	57.86	128.21
1.0	0.625	0.750	6	6	22.08	52.00	114.19	1.2	0.625	0.750	7	5	25.26	57.26	121.22
1.0	0.625	0.750	7	6	22.02	51.56	113.16	1.2	0.625	0.750	6	6	24.99	57.46	127.24
1.0	0.625	0.750	6	7	21.85	51.56	113.16	1.2	0.625	0.750	7	6	24.86	49.47	112.88
1.0	0.625	0.750	7	7	21.77	45.05	101.61	1.2	0.750	0.625	6	5	21.32	91.93	183.96
1.0	0.750	0.625	6	6	18.55	82.35	164.42	1.2	0.750	0.625	7	5	20.90	86.48	171.07
1.0	0.750	0.625	7	6	18.30	80.87	161.43	1.2	0.750	0.625	6	6	20.75	90.44	180.93
1.0	0.750	0.625	6	7	18.08	80.87	161.43	1.2	0.750	0.625	7	6	20.35	81.12	163.47
1.0	0.750	0.625	7	7	17.85	73.33	147.37	1.2	0.750	0.750	6	5	19.12	56.02	117.38
1.0	0.750	0.750	6	6	16.62	50.19	104.63	1.2	0.750	0.750	7	5	18.88	53.99	110.10
1.0	0.750	0.750	7	6	16.48	49.57	103.29	1.2	0.750	0.750	6	6	18.70	55.42	116.06
1.0	0.750	0.750	6	7	16.31	49.57	103.29	1.2	0.750	0.750	7	6	18.48	48.71	103.80
1.0	0.750	0.750	7	7	16.19	44.10	93.38	1.2	0.875	0.625	6	5	17.64	85.13	168.24
1.0	0.875	0.625	6	6	15.36	76.24	150.47	1.2	0.875	0.625	7	5	17.18	77.65	154.14
1.0	0.875	0.625	7	6	15.09	74.46	146.93	1.2	0.875	0.625	6	6	17.10	83.34	164.66
1.0	0.875	0.625	6	7	14.88	74.46	146.93	1.2	0.875	0.750	7	6	16.67	76.07	150.98
1.0	0.875	0.625	7	7	14.63	68.64	136.02	1.2	0.875	0.750	6	5	15.40	53.42	108.69
1.0	0.875	0.750	6	6	13.39	47.77	96.89	1.2	0.875	0.750	7	5	15.10	50.23	100.45
1.0	0.875	0.750	7	6	13.22	46.95	95.20	1.2	0.875	0.750	6	6	14.99	52.60	106.98
1.0	0.875	0.750	6	7	13.05	46.95	95.20	1.2	0.875	0.750	7	6	14.72	47.04	96.72
1.0	0.875	0.750	7	7	12.90	42.43	86.92	1.2	1.000	0.625	6	5	15.18	77.69	152.43
1.0	1.000	0.625	6	6	13.24	69.69	136.64	1.2	1.000	0.625	7	5	14.71	71.91	141.51
1.0	1.000	0.625	7	6	12.96	67.78	132.87	1.2	1.000	0.625	6	6	14.69	75.77	148.64
1.0	1.000	0.625	6	7	12.79	67.78	132.87	1.2	1.000	0.625	7	6	14.26	70.23	138.19
1.0	1.000	0.625	7	7	12.53	63.40	124.64	1.2	1.000	0.750	6	5	12.99	50.32	100.67
1.0	1.000	0.750	6	6	11.31	44.97	89.79	1.2	1.000	0.750	7	5	12.67	45.66	91.99
1.0	1.000	0.750	7	6	11.12	43.99	87.81	1.2	1.000	0.750	6	6	12.61	49.33	98.65

PLATE AREA - 700.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.2	1.000	0.750	7	6	12.31	44.77	90.19	1.4	0.875	0.625	7	6	17.18	78.19	155.26
1.4	0.500	0.625	7	5	39.66	89.27	198.80	1.4	0.875	0.625	8	6	16.72	68.27	136.17
1.4	0.500	0.625	8	5	39.33	86.69	178.68	1.4	0.875	0.750	6	5	15.80	55.36	112.75
1.4	0.500	0.625	7	6	39.22	88.86	197.85	1.4	0.875	0.750	8	5	15.40	49.07	101.03
1.4	0.500	0.625	8	6	38.90	76.61	173.95	1.4	0.875	0.750	6	6	15.09	42.34	88.09
1.4	0.500	0.750	6	5	38.21	60.71	152.67	1.4	0.875	0.750	7	6	15.49	54.79	111.54
1.4	0.500	0.750	7	5	38.13	50.38	134.16	1.4	0.875	0.750	8	6	15.12	48.50	99.84
1.4	0.500	0.750	8	5	37.96	43.29	120.10	1.4	1.000	0.625	6	5	14.82	41.92	87.20
1.4	0.500	0.750	6	6	37.85	60.54	152.18	1.4	1.000	0.625	7	5	15.66	79.70	156.40
1.4	0.500	0.750	7	6	37.83	50.18	133.65	1.4	1.000	0.625	8	5	15.07	73.27	144.21
1.4	0.500	0.750	8	6	37.66	43.17	119.73	1.4	1.000	0.625	6	6	14.60	64.50	127.35
1.4	0.625	0.625	7	5	27.66	88.07	183.22	1.4	1.000	0.625	7	6	15.28	78.26	153.55
1.4	0.625	0.625	8	5	27.26	80.16	160.29	1.4	1.000	0.625	8	6	14.72	72.00	141.70
1.4	0.625	0.625	7	6	27.24	87.32	181.65	1.4	1.000	0.750	6	5	14.27	63.48	125.33
1.4	0.625	0.625	8	6	26.84	75.27	158.35	1.4	1.000	0.750	7	5	13.36	51.99	104.05
1.4	0.625	0.750	6	5	26.02	60.16	133.83	1.4	1.000	0.750	8	5	12.94	46.78	94.30
1.4	0.625	0.750	7	5	25.78	51.28	117.58	1.4	1.000	0.750	8	6	12.61	40.63	82.51
1.4	0.625	0.750	8	5	25.55	44.00	103.42	1.4	1.000	0.750	6	6	13.07	51.27	102.58
1.4	0.625	0.750	6	6	25.69	59.89	133.17	1.4	1.000	0.750	7	6	12.67	46.11	92.95
1.4	0.625	0.750	7	6	25.48	50.94	116.82	1.4	1.000	0.750	8	6	12.36	40.12	81.46
1.4	0.625	0.750	8	6	25.25	43.79	102.88	1.6	0.500	0.625	7	5	38.52	88.56	197.63
1.4	0.750	0.625	6	5	21.90	95.10	190.45	1.6	0.500	0.625	8	5	38.12	76.67	174.59
1.4	0.750	0.625	7	5	21.33	84.51	170.48	1.6	0.500	0.750	7	5	36.92	49.98	133.51
1.4	0.750	0.625	8	5	20.87	73.07	148.46	1.6	0.500	0.750	8	5	36.70	43.20	120.28
1.4	0.750	0.625	6	6	21.46	94.04	188.28	1.6	0.625	0.625	7	5	26.99	87.39	181.97
1.4	0.750	0.625	7	6	20.92	83.50	168.44	1.6	0.625	0.625	8	5	26.50	75.49	159.02
1.4	0.750	0.625	8	6	20.48	72.32	146.90	1.6	0.625	0.750	7	5	25.03	50.91	116.89
1.4	0.750	0.750	6	5	19.59	58.19	122.16	1.6	0.625	0.750	8	5	24.75	43.89	103.34
1.4	0.750	0.750	7	5	19.25	50.68	108.26	1.6	0.750	0.625	7	5	20.92	83.84	169.18
1.4	0.750	0.750	8	5	18.97	43.53	94.49	1.6	0.750	0.625	8	5	20.38	72.65	147.66
1.4	0.750	0.750	6	6	19.27	57.78	121.25	1.6	0.750	0.750	7	5	18.77	50.33	107.59
1.4	0.750	0.750	7	6	18.95	50.21	107.28	1.6	0.750	0.750	8	5	18.43	43.39	94.25
1.4	0.750	0.750	8	6	18.68	43.22	93.77	1.6	0.875	0.625	7	5	17.31	78.65	156.17
1.4	0.875	0.625	6	5	18.16	87.73	173.43	1.6	0.875	0.625	8	5	16.75	68.64	136.94
1.4	0.875	0.625	7	5	17.55	79.38	157.63	1.6	0.875	0.750	7	5	15.08	48.74	100.35
1.4	0.875	0.625	8	5	17.08	69.19	138.04	1.6	0.875	0.750	8	5	14.71	42.15	87.72
1.4	0.875	0.625	6	6	17.74	86.41	170.79	1.6	1.000	0.625	7	5	14.93	72.43	142.54

PLATE AREA - 700.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	1.000	0.625	8	5	14.39	63.81	125.97	1.8	0.750	0.750	8	5	17.49	42.45	92.14
1.6	1.000	0.750	7	5	12.73	46.42	93.56	1.8	0.750	0.750	9	5	17.20	37.29	82.36
1.6	1.000	0.750	8	5	12.35	40.38	81.99	1.8	0.875	0.625	7	4	17.32	77.84	154.41
1.8	0.500	0.625	7	4	38.34	89.19	197.78	1.8	0.875	0.625	8	4	16.68	67.62	134.85
1.8	0.500	0.625	8	4	37.86	75.94	172.71	1.8	0.875	0.625	9	4	16.17	61.41	122.95
1.8	0.500	0.625	9	4	37.50	66.96	155.21	1.8	0.875	0.625	7	5	16.74	76.50	151.86
1.8	0.500	0.625	7	5	36.46	86.16	192.35	1.8	0.875	0.625	8	5	16.13	66.91	133.46
1.8	0.500	0.625	8	5	36.01	74.99	170.91	1.8	0.875	0.625	9	5	15.64	60.41	121.06
1.8	0.500	0.625	9	5	35.66	64.74	151.27	1.8	0.875	0.750	7	4	14.98	48.40	99.39
1.8	0.500	0.750	7	4	36.39	50.99	133.08	1.8	0.875	0.750	8	4	14.55	41.60	86.47
1.8	0.500	0.750	8	4	36.11	42.89	118.83	1.8	0.875	0.750	9	4	14.22	37.33	78.30
1.8	0.500	0.750	9	4	35.91	37.41	107.87	1.8	0.875	0.750	7	5	14.46	47.49	97.72
1.8	0.500	0.750	7	5	35.48	48.62	129.78	1.8	0.875	0.750	8	5	14.05	41.21	85.70
1.8	0.500	0.750	8	5	35.75	42.29	117.73	1.8	1.000	0.500	9	5	13.73	36.64	77.04
1.8	0.625	0.625	7	4	26.90	67.24	181.12	1.8	1.000	0.500	8	5	17.41	100.25	195.33
1.8	0.625	0.625	8	4	26.33	74.57	156.97	1.8	1.000	0.625	9	5	16.76	93.69	182.73
1.8	0.625	0.625	9	4	25.89	66.44	141.30	1.8	1.000	0.625	7	4	14.97	71.49	140.56
1.8	0.625	0.625	7	5	25.72	85.08	177.14	1.8	1.000	0.625	8	4	14.35	62.76	123.86
1.8	0.625	0.625	8	5	25.18	73.80	155.49	1.8	1.000	0.625	9	4	13.85	57.56	113.89
1.8	0.625	0.625	9	5	24.76	64.80	138.30	1.8	1.000	0.625	7	5	14.53	70.32	138.33
1.8	0.625	0.750	7	4	24.73	51.06	116.35	1.8	1.000	0.625	8	5	13.94	62.05	122.46
1.8	0.625	0.750	8	4	24.39	43.44	102.03	1.8	1.000	0.750	9	5	13.45	56.71	112.26
1.8	0.625	0.750	9	4	24.13	38.32	92.06	1.8	1.000	0.750	7	4	12.68	45.99	92.51
1.8	0.625	0.750	7	5	23.69	49.56	113.72	1.8	1.000	0.750	8	4	12.24	39.82	80.78
1.8	0.625	0.750	8	5	23.37	42.96	101.11	1.8	1.000	0.750	9	4	11.89	36.02	73.53
1.8	0.625	0.750	9	5	23.11	37.21	90.16	1.8	1.000	0.750	7	5	12.28	45.21	91.06
1.8	0.750	0.625	7	4	20.88	83.26	167.73	1.8	1.000	0.750	8	5	11.86	39.42	80.00
1.8	0.750	0.625	8	4	20.26	71.65	145.56	2.0	0.500	0.625	9	5	11.52	35.45	72.45
1.8	0.750	0.625	9	4	19.77	64.46	131.74	2.0	0.500	0.625	7	4	35.62	85.42	189.42
1.8	0.750	0.625	7	5	20.08	81.62	164.67	2.0	0.500	0.625	8	4	35.11	73.35	166.79
1.8	0.750	0.625	8	5	19.49	70.95	144.19	2.0	0.500	0.625	9	4	34.73	64.07	148.52
1.8	0.750	0.625	9	5	19.02	63.22	129.43	2.0	0.500	0.625	7	5	34.07	82.96	185.10
1.8	0.750	0.750	7	4	18.58	50.17	106.80	2.0	0.500	0.625	8	5	33.58	72.64	165.47
1.8	0.750	0.750	8	4	18.19	42.87	92.97	2.0	0.500	0.625	9	5	33.21	62.30	145.45
1.8	0.750	0.750	9	4	17.89	38.15	83.90	2.0	0.500	0.750	7	4	33.63	48.41	127.19
1.8	0.750	0.750	7	5	17.87	49.04	104.75	2.0	0.500	0.750	8	4	34.00	41.46	114.63
1.8	0.750	0.750	8	5	17.87	49.04	104.75	2.0	0.500	0.750	9	4	33.44	35.79	103.01

PLATE AREA - 700.0000

MAXIMUM STRESSES								MAXIMUM STRESSES							
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
2.0	0.500	0.750	7	5	33.65	46.82	124.60	2.0	0.875	0.750	7	5	13.71	45.80	94.12
2.0	0.500	0.750	8	5	34.10	41.01	113.84	2.0	0.875	0.750	8	5	13.28	39.89	82.86
2.0	0.500	0.750	9	5	33.88	34.68	101.29	2.0	0.875	0.750	9	5	12.94	35.29	74.09
2.0	0.625	0.625	7	4	25.19	83.73	173.78	2.0	1.000	0.500	8	4	17.20	96.79	188.54
2.0	0.625	0.625	8	4	24.99	72.01	151.53	2.0	1.000	0.500	9	4	16.90	90.40	176.24
2.0	0.625	0.625	9	4	24.13	63.68	135.40	2.0	1.000	0.500	8	5	16.85	95.90	186.80
2.0	0.625	0.625	7	5	24.24	81.97	170.59	2.0	1.000	0.500	9	5	16.18	89.43	174.38
2.0	0.625	0.625	8	5	23.65	71.44	150.45	2.0	1.000	0.625	7	4	14.36	68.45	134.54
2.0	0.625	0.625	9	5	23.20	62.37	133.03	2.0	1.000	0.625	8	4	13.71	60.27	118.88
2.0	0.625	0.750	7	4	22.99	48.98	111.48	2.0	1.000	0.625	9	4	13.19	55.08	108.94
2.0	0.625	0.750	8	4	22.62	42.00	98.49	2.0	1.000	0.625	7	5	14.00	67.55	132.82
2.0	0.625	0.750	9	4	22.35	36.72	88.10	2.0	1.000	0.625	8	5	13.38	59.75	117.87
2.0	0.625	0.750	7	5	22.15	47.76	109.38	2.0	1.000	0.625	9	5	12.88	54.43	107.69
2.0	0.625	0.750	8	5	21.79	41.64	97.82	2.0	1.000	0.750	7	4	12.05	44.18	88.81
2.0	0.625	0.750	9	5	21.52	35.83	86.61	2.0	1.000	0.750	8	4	11.58	38.39	77.81
2.0	0.750	0.625	7	4	19.73	79.95	161.01	2.0	1.000	0.750	9	4	11.22	34.57	70.49
2.0	0.750	0.625	8	4	19.07	69.12	140.35	2.0	1.000	0.750	7	5	11.73	43.57	87.67
2.0	0.750	0.625	9	4	18.97	61.82	126.30	2.0	1.000	0.750	8	5	11.28	38.11	77.25
2.0	0.750	0.625	7	5	19.09	78.64	158.98	2.0	1.000	0.750	9	5	10.93	34.12	69.66
2.0	0.750	0.625	8	5	18.45	68.61	139.36	4.0	0.500	0.375	18	4	22.97	96.74	193.34
2.0	0.750	0.625	9	5	17.96	60.83	124.48	4.0	0.500	0.375	18	5	22.49	95.84	191.62
2.0	0.750	0.750	7	4	17.39	48.21	102.51	4.0	0.500	0.500	10	3	20.09	78.40	162.05
2.0	0.750	0.750	8	4	16.98	41.43	89.74	4.0	0.500	0.500	11	3	19.67	77.32	149.80
2.0	0.750	0.750	9	4	16.66	36.61	80.41	4.0	0.500	0.500	12	3	19.32	75.71	146.69
2.0	0.750	0.750	7	5	16.82	47.28	100.86	4.0	0.500	0.500	13	3	19.02	74.35	144.03
2.0	0.750	0.750	8	5	16.42	41.13	89.16	4.0	0.500	0.625	10	3	18.01	50.45	97.89
2.0	0.750	0.750	9	5	16.11	35.91	79.19	4.0	0.500	0.625	11	3	17.93	49.61	96.26
2.0	0.875	0.500	9	4	18.85	101.65	198.99	4.0	0.500	0.625	12	3	18.24	48.92	94.90
2.0	0.875	0.500	7	4	18.41	100.46	196.71	4.0	0.500	0.625	13	3	18.19	48.33	93.75
2.0	0.875	0.625	7	4	16.50	74.69	148.09	4.0	0.500	0.750	10	3	19.19	23.38	65.57
2.0	0.875	0.625	8	4	15.83	65.10	129.76	4.0	0.500	0.750	11	3	18.89	32.82	63.93
2.0	0.875	0.625	9	4	15.30	58.86	117.79	4.0	0.500	0.750	12	3	19.19	32.48	63.27
2.0	0.875	0.625	7	5	16.03	73.63	146.10	4.0	0.500	0.750	13	3	18.98	32.20	62.71
2.0	0.875	0.625	8	5	15.39	64.59	128.77	4.0	0.625	0.375	16	4	18.84	98.27	192.86
2.0	0.875	0.625	9	5	14.88	58.08	116.32	4.0	0.625	0.375	17	4	18.44	93.51	183.70
2.0	0.875	0.750	7	4	14.13	46.53	95.46	4.0	0.625	0.375	18	4	18.08	88.91	174.84
2.0	0.875	0.750	8	4	13.68	40.17	83.41	4.0	0.625	0.375	18	4	18.08	88.91	174.84
2.0	0.875	0.750	9	4	13.33	35.83	75.09	4.0	0.625	0.375	16	5	18.60	97.72	191.80

PLATE AREA - 700.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
4.0	0.625	0.375	17	5	18.20	92.86	182.45	4.0	0.875	0.375	15	4	14.30	75.98	147.64
4.0	0.625	0.375	18	5	17.85	88.38	173.82	4.0	0.875	0.375	16	4	13.97	72.86	141.62
4.0	0.625	0.500	10	3	16.00	73.28	146.48	4.0	0.875	0.375	17	4	13.66	70.31	136.71
4.0	0.625	0.500	11	3	15.51	67.31	135.04	4.0	0.875	0.375	18	4	13.37	67.64	131.58
4.0	0.625	0.500	12	3	15.10	61.71	124.53	4.0	0.875	0.375	10	5	16.40	94.48	183.24
4.0	0.625	0.500	13	3	14.76	57.42	116.10	4.0	0.875	0.375	11	5	15.88	90.32	175.25
4.0	0.625	0.625	10	3	12.87	40.17	85.20	4.0	0.875	0.375	12	5	15.41	85.91	166.76
4.0	0.625	0.625	11	3	12.60	36.49	78.14	4.0	0.875	0.375	13	5	14.98	82.40	159.99
4.0	0.625	0.625	12	3	12.37	37.87	73.32	4.0	0.875	0.375	14	5	14.58	78.75	152.96
4.0	0.625	0.625	13	3	12.18	37.14	71.90	4.0	0.875	0.375	15	5	14.22	75.75	147.18
4.0	0.625	0.750	10	3	11.83	23.72	56.01	4.0	0.875	0.375	16	5	13.88	72.67	141.26
4.0	0.625	0.750	11	3	11.81	26.69	51.73	4.0	0.875	0.375	17	5	13.57	70.09	136.29
4.0	0.625	0.750	12	3	12.02	26.23	50.84	4.0	0.875	0.375	18	5	13.29	67.46	131.23
4.0	0.625	0.750	13	3	12.02	25.85	50.09	4.0	0.875	0.500	10	3	12.06	58.20	113.72
4.0	0.750	0.375	13	4	17.36	99.84	194.36	4.0	0.875	0.500	11	3	11.60	54.56	106.75
4.0	0.750	0.375	14	4	16.87	94.53	184.14	4.0	0.875	0.500	12	3	11.21	50.79	99.52
4.0	0.750	0.375	15	4	16.42	90.23	175.85	4.0	0.875	0.500	13	3	10.86	47.96	94.11
4.0	0.750	0.375	16	4	16.02	85.89	167.50	4.0	1.000	0.375	10	4	14.15	74.69	144.71
4.0	0.750	0.375	17	4	15.65	82.31	160.60	4.0	1.000	0.375	11	4	13.78	72.29	140.09
4.0	0.750	0.375	18	4	15.31	78.70	153.65	4.0	1.000	0.375	12	4	13.43	69.33	134.38
4.0	0.750	0.375	13	5	17.21	99.40	193.50	4.0	1.000	0.375	13	4	13.10	67.16	130.21
4.0	0.750	0.375	14	5	16.72	94.21	183.52	4.0	1.000	0.375	14	4	12.80	64.64	125.36
4.0	0.750	0.375	15	5	16.28	89.82	175.07	4.0	1.000	0.375	15	4	12.52	62.70	121.63
4.0	0.750	0.375	16	5	15.88	85.58	166.90	4.0	1.000	0.375	16	4	12.26	60.54	117.45
4.0	0.750	0.375	17	5	15.52	81.94	159.89	4.0	1.000	0.375	17	4	12.01	58.80	114.11
4.0	0.750	0.375	18	5	15.18	78.39	153.07	4.0	1.000	0.375	18	4	11.78	56.91	110.47
4.0	0.750	0.500	10	3	13.67	66.23	130.40	4.0	1.000	0.375	10	5	14.09	74.59	144.51
4.0	0.750	0.500	11	3	13.17	61.46	121.26	4.0	1.000	0.375	11	5	13.72	72.13	139.77
4.0	0.750	0.500	12	3	12.75	56.73	112.22	4.0	1.000	0.375	12	5	13.37	69.21	134.16
4.0	0.750	0.500	13	3	12.39	53.17	105.40	4.0	1.000	0.375	13	5	13.05	67.01	129.91
4.0	0.750	0.625	10	3	10.65	38.22	77.82	4.0	1.000	0.375	14	5	12.75	64.53	125.14
4.0	0.750	0.625	11	3	10.34	35.03	71.75	4.0	1.000	0.375	15	5	12.47	62.56	121.36
4.0	0.750	0.625	12	3	10.08	32.07	66.13	4.0	1.000	0.375	16	5	12.21	60.42	117.24
4.0	0.875	0.375	10	4	16.50	94.65	183.57	4.0	1.000	0.375	17	5	11.96	58.67	113.86
4.0	0.875	0.375	11	4	15.97	90.61	175.79	4.0	1.000	0.375	18	5	11.73	56.80	110.26
4.0	0.875	0.375	12	4	15.50	86.10	167.12	4.0	1.000	0.500	10	3	10.76	50.05	97.36
4.0	0.875	0.375	13	4	15.07	82.66	160.48	4.0	1.000	0.500	11	3	10.37	47.39	92.27
4.0	0.875	0.375	14	4	14.67	78.94	153.32	4.0	1.000	0.500	12	3	10.02	44.50	86.74

PLATE AREA - 750.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.625	7	7	35.92	87.91	191.25	1.2	0.500	0.625	8	6	40.71	82.45	184.46
1.0	0.500	0.750	6	6	34.72	58.68	142.00	1.2	0.500	0.750	6	5	39.96	65.01	159.88
1.0	0.500	0.750	7	6	34.80	58.30	141.06	1.2	0.500	0.750	7	5	39.95	66.18	150.37
1.0	0.500	0.750	6	7	34.62	58.30	141.06	1.2	0.500	0.750	6	6	39.48	64.72	159.09
1.0	0.500	0.750	7	7	34.63	49.89	126.65	1.2	0.500	0.750	7	6	39.53	54.27	140.80
1.0	0.625	0.625	6	6	25.54	97.41	198.23	1.2	0.625	0.625	7	6	28.42	94.21	194.72
1.0	0.625	0.625	7	6	25.36	96.19	195.69	1.2	0.625	0.625	8	6	28.11	81.01	169.13
1.0	0.625	0.625	6	7	25.10	96.19	195.69	1.2	0.625	0.750	6	5	27.21	64.32	141.40
1.0	0.625	0.625	7	7	24.93	85.60	176.05	1.2	0.625	0.750	7	5	27.05	63.71	134.14
1.0	0.625	0.750	6	6	23.64	57.83	126.04	1.2	0.625	0.750	6	6	26.75	63.86	140.32
1.0	0.625	0.750	7	6	23.57	57.33	124.90	1.2	0.625	0.750	7	6	26.61	54.97	124.26
1.0	0.625	0.750	6	7	23.39	57.33	124.90	1.2	0.750	0.625	7	5	22.39	96.10	189.87
1.0	0.625	0.750	7	7	23.32	50.09	111.98	1.2	0.750	0.625	8	5	22.02	94.34	186.35
1.0	0.750	0.625	6	6	19.87	91.47	182.29	1.2	0.750	0.625	7	6	21.80	90.08	181.08
1.0	0.750	0.625	7	6	19.61	89.83	178.98	1.2	0.750	0.625	8	6	21.45	77.93	157.64
1.0	0.750	0.625	6	7	19.36	89.83	178.98	1.2	0.750	0.750	6	5	20.48	62.24	129.80
1.0	0.750	0.625	7	7	19.12	81.46	163.34	1.2	0.750	0.750	7	5	20.21	60.04	122.06
1.0	0.750	0.750	6	6	17.79	55.79	115.77	1.2	0.750	0.750	6	6	20.02	61.56	128.33
1.0	0.750	0.750	7	6	17.65	55.10	114.30	1.2	0.750	0.750	7	6	19.78	54.11	114.65
1.0	0.750	0.750	6	7	17.47	55.10	114.30	1.2	0.875	0.625	7	5	18.90	84.52	186.56
1.0	0.750	0.750	7	7	17.34	49.02	103.23	1.2	0.875	0.625	8	5	18.40	86.21	170.88
1.0	0.875	0.625	6	6	16.46	84.66	166.91	1.2	0.875	0.625	6	6	18.01	84.71	166.06
1.0	0.875	0.625	7	6	16.16	82.69	162.99	1.2	0.875	0.625	6	6	18.32	92.52	182.59
1.0	0.875	0.625	6	7	15.95	82.69	162.99	1.2	0.875	0.625	7	6	17.86	84.46	167.39
1.0	0.875	0.625	7	7	15.68	76.24	150.87	1.2	0.875	0.625	8	6	17.49	73.74	146.74
1.0	0.875	0.750	6	6	14.34	53.07	107.35	1.2	0.875	0.750	6	5	16.49	59.33	120.36
1.0	0.875	0.750	7	6	14.16	52.17	105.48	1.2	0.875	0.750	7	5	16.17	55.84	111.47
1.0	0.875	0.750	6	7	13.98	52.17	105.48	1.2	0.875	0.750	6	6	16.05	58.42	118.47
1.0	0.875	0.750	7	7	13.82	47.15	96.26	1.2	0.875	0.750	7	6	15.76	52.24	107.03
1.0	1.000	0.625	6	6	14.19	77.38	151.61	1.2	1.000	0.625	6	5	16.26	86.23	169.08
1.0	1.000	0.625	7	6	13.89	75.26	147.44	1.2	1.000	0.625	7	5	15.77	79.83	156.96
1.0	1.000	0.625	6	7	13.70	75.26	147.43	1.2	1.000	0.625	8	5	15.37	75.51	147.39
1.0	1.000	0.625	7	7	13.43	70.40	138.50	1.2	1.000	0.625	6	6	15.74	84.11	164.89
1.0	1.000	0.750	6	6	12.11	49.95	99.56	1.2	1.000	0.625	7	6	15.28	77.97	153.29
1.0	1.000	0.750	7	6	11.91	48.87	97.37	1.2	1.000	0.625	8	6	14.91	68.79	135.62
1.0	1.000	0.750	6	7	11.75	48.87	97.37	1.2	1.000	0.750	6	5	13.91	55.87	111.57
1.0	1.000	0.750	7	7	11.57	44.79	89.82	1.2	1.000	0.750	7	5	13.58	50.70	101.91
1.0	1.000	0.750	6	7	11.57	44.79	89.82	1.2	1.000	0.750	6	6	13.50	54.78	109.34

PLATE AREA - 750.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.2	1.000	0.750	7	6	13.19	49.72	99.92	1.6	0.500	0.625	8	5	40.83	85.19	192.20
1.4	0.500	0.625	8	5	42.12	96.44	198.01	1.6	0.500	0.625	9	5	40.51	74.03	171.04
1.4	0.500	0.625	8	6	41.66	89.14	191.53	1.6	0.500	0.750	7	5	39.54	55.57	145.99
1.4	0.500	0.750	7	5	40.82	56.02	146.68	1.6	0.500	0.750	8	5	39.30	48.09	131.40
1.4	0.500	0.750	8	5	40.64	48.20	131.19	1.6	0.500	0.750	9	5	39.12	41.26	118.57
1.4	0.500	0.750	7	6	40.49	53.82	146.16	1.6	0.625	0.625	8	5	28.39	83.83	175.71
1.4	0.500	0.750	8	6	40.32	48.07	130.79	1.6	0.625	0.625	9	5	27.99	74.04	157.12
1.4	0.500	0.625	8	5	29.20	89.15	177.91	1.6	0.625	0.750	7	5	26.81	56.54	128.61
1.4	0.625	0.625	8	6	28.79	83.60	175.00	1.6	0.625	0.750	8	5	26.50	48.77	113.62
1.4	0.625	0.750	7	5	27.60	56.96	129.37	1.6	0.750	0.625	9	5	26.26	42.53	101.88
1.4	0.625	0.750	8	5	27.35	48.91	113.71	1.6	0.750	0.625	7	5	22.41	93.05	187.31
1.4	0.625	0.750	7	6	27.28	56.60	128.56	1.6	0.750	0.625	8	5	21.83	80.65	163.45
1.4	0.625	0.750	8	6	27.03	48.67	113.13	1.6	0.750	0.625	9	5	21.38	72.24	147.45
1.4	0.750	0.625	7	5	22.85	93.81	188.79	1.6	0.750	0.750	8	5	19.74	48.19	103.99
1.4	0.750	0.625	8	5	22.36	81.13	164.36	1.6	0.750	0.750	9	5	19.46	42.58	93.43
1.4	0.750	0.625	7	6	22.41	92.69	186.54	1.6	0.875	0.625	7	5	18.55	87.28	173.07
1.4	0.750	0.625	8	6	21.94	80.29	162.63	1.6	0.875	0.625	8	5	17.95	76.18	151.73
1.4	0.750	0.750	7	5	20.62	56.26	119.53	1.6	0.875	0.625	9	5	17.47	69.10	138.22
1.4	0.750	0.750	8	5	20.32	48.35	104.27	1.6	0.875	0.750	7	5	16.16	54.09	110.99
1.4	0.750	0.750	7	6	20.30	55.75	118.45	1.6	0.875	0.750	8	5	15.76	46.79	96.99
1.4	0.750	0.750	8	6	20.01	48.00	103.48	1.6	0.875	0.750	9	5	15.45	41.84	87.62
1.4	0.875	0.625	7	5	18.81	88.11	174.71	1.6	1.000	0.625	7	5	16.00	80.38	158.04
1.4	0.875	0.625	8	5	18.30	76.81	152.97	1.6	1.000	0.625	8	5	15.42	70.81	139.65
1.4	0.875	0.625	7	6	18.40	86.79	172.10	1.6	1.000	0.625	9	5	14.94	64.96	128.48
1.4	0.875	0.625	8	6	17.92	75.78	150.90	1.6	1.000	0.750	7	5	13.64	51.52	103.60
1.4	0.875	0.750	7	5	16.50	54.48	111.76	1.6	1.000	0.750	8	5	13.23	44.82	90.77
1.4	0.875	0.750	8	5	16.17	47.01	97.42	1.6	1.000	0.750	9	5	12.90	40.49	82.58
1.4	0.875	0.750	7	6	16.20	53.84	110.46								
1.4	0.875	0.750	8	6	15.87	46.55	96.43	1.8	0.500	0.625	8	5	38.57	83.32	188.15
1.4	1.000	0.625	7	5	16.15	81.32	159.92	1.8	0.500	0.625	9	5	38.20	71.93	166.30
1.4	1.000	0.625	8	5	15.64	71.59	141.20	1.8	0.500	0.750	7	5	37.24	54.05	141.97
1.4	1.000	0.625	7	6	15.78	79.92	157.15	1.8	0.500	0.750	8	5	37.39	47.07	128.65
1.4	1.000	0.625	8	6	15.30	70.46	138.96	1.8	0.500	0.750	9	5	37.51	40.10	113.19
1.4	1.000	0.750	7	5	13.86	51.93	104.44	1.8	0.625	0.625	7	5	27.56	94.42	195.79
1.4	1.000	0.750	8	5	13.51	45.11	91.36	1.8	0.625	0.625	8	5	26.97	81.94	171.80
1.4	1.000	0.750	7	6	13.58	51.19	102.95	1.8	0.625	0.625	9	5	26.52	71.94	152.68
1.4	1.000	0.750	8	6	13.24	44.55	90.20	1.8	0.625	0.750	7	5	25.38	55.03	125.14

PLATE AREA - 750.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.8	0.625	0.750	8	5	25.03	47.73	111.19	2.0	0.625	0.625	10	5	24.48	62.23	133.48
1.8	0.625	0.750	9	5	24.76	41.34	99.00	2.0	0.625	0.750	8	4	24.27	46.67	108.35
1.8	0.750	0.625	7	5	21.52	90.58	182.31	2.0	0.625	0.750	9	4	23.98	40.81	96.83
1.8	0.750	0.625	8	5	20.88	78.75	159.59	2.0	0.625	0.750	10	4	23.75	36.29	88.42
1.8	0.750	0.625	9	5	20.38	70.17	143.19	2.0	0.625	0.750	8	5	23.35	46.26	107.59
1.8	0.750	0.750	7	5	19.14	54.42	115.64	2.0	0.625	0.750	9	5	23.06	39.80	95.13
1.8	0.750	0.750	8	5	18.74	47.14	101.70	2.0	0.625	0.750	10	5	22.83	35.76	87.49
1.8	0.750	0.750	9	5	18.42	41.40	90.79	2.0	0.750	0.625	8	4	20.45	76.71	155.34
1.8	0.875	0.625	7	5	17.94	84.89	168.28	2.0	0.750	0.625	9	4	19.91	68.62	139.76
1.8	0.875	0.625	8	5	17.28	74.26	147.87	2.0	0.750	0.625	10	4	19.47	61.36	125.90
1.8	0.875	0.625	9	5	16.76	67.04	134.08	2.0	0.750	0.625	8	5	19.77	76.14	154.24
1.8	0.875	0.750	7	5	15.49	52.70	108.08	2.0	0.750	0.625	9	5	19.24	67.51	137.71
1.8	0.875	0.750	8	5	15.05	45.74	94.75	2.0	0.750	0.625	10	5	18.82	60.72	124.70
1.8	0.875	0.750	9	5	14.71	40.67	85.12	2.0	0.750	0.750	8	4	18.21	46.00	99.04
1.8	1.000	0.625	7	5	15.57	78.03	153.37	2.0	0.750	0.750	9	4	17.87	40.65	88.69
1.8	1.000	0.625	8	5	14.93	68.86	135.75	2.0	0.750	0.750	10	4	17.60	36.22	80.33
1.8	1.000	0.625	9	5	14.42	62.93	124.42	2.0	0.750	0.750	8	5	17.59	45.66	98.39
1.8	1.000	0.750	7	5	13.16	50.17	100.83	2.0	0.750	0.750	9	5	17.26	39.87	87.31
1.8	1.000	0.750	8	5	12.70	43.75	88.95	2.0	0.750	0.750	10	5	16.99	35.79	79.55
1.8	1.000	0.750	9	5	12.34	39.34	80.17	2.0	0.875	0.500	10	5	19.05	101.64	199.21
2.0	0.500	0.625	8	4	37.66	81.50	183.65	2.0	0.875	0.625	8	4	16.97	72.24	143.76
2.0	0.500	0.625	9	4	37.25	71.20	163.40	2.0	0.875	0.625	9	4	16.41	65.32	130.47
2.0	0.500	0.625	10	4	36.93	63.39	148.76	2.0	0.875	0.625	10	4	15.94	58.70	117.81
2.0	0.500	0.625	8	5	35.98	80.69	182.16	2.0	0.875	0.625	8	5	16.49	71.67	142.66
2.0	0.500	0.625	9	5	35.58	69.20	159.92	2.0	0.875	0.625	9	5	15.94	64.44	128.82
2.0	0.500	0.625	10	5	35.26	62.33	146.88	2.0	0.875	0.625	10	5	15.49	58.16	116.76
2.0	0.500	0.750	8	4	35.76	46.15	125.35	2.0	0.875	0.750	8	4	14.67	44.58	92.22
2.0	0.500	0.750	9	4	35.53	39.85	112.50	2.0	0.875	0.750	9	4	14.29	39.78	83.00
2.0	0.500	0.750	10	4	35.73	35.35	104.38	2.0	0.875	0.750	10	4	14.00	35.53	74.95
2.0	0.500	0.750	8	5	35.83	45.63	124.45	2.0	0.875	0.750	8	5	14.23	44.26	91.61
2.0	0.500	0.750	9	5	35.62	38.59	110.53	2.0	0.875	0.750	9	5	13.86	39.16	81.87
2.0	0.500	0.750	10	5	35.95	34.69	103.31	2.0	0.875	0.750	10	5	13.57	35.18	74.28
2.0	0.625	0.625	8	4	26.37	79.95	167.43	2.0	1.000	0.500	9	4	17.69	100.30	195.49
2.0	0.625	0.625	9	4	25.88	70.71	149.55	2.0	1.000	0.500	10	4	17.05	92.09	179.68
2.0	0.625	0.625	10	4	25.49	63.04	134.97	2.0	1.000	0.500	9	5	17.34	99.22	193.41
2.0	0.625	0.625	8	5	25.34	79.31	166.22	2.0	1.000	0.500	10	5	16.73	91.27	178.10
2.0	0.625	0.625	9	5	24.86	69.23	146.86	2.0	1.000	0.625	8	4	14.70	66.87	131.77
2.0	0.625	0.625	9	5	24.86	69.23	146.86	2.0	1.000	0.625	9	4	14.14	61.12	120.74

PLATE AREA - 750.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL				
2.0	1.000	0.625	10	4	13.68	55.28	109.56	4.0	0.625	0.750	10	3	12.65	26.30	61.64				
2.0	1.000	0.625	8	5	14.34	66.30	130.65	4.0	0.625	0.750	11	3	12.63	29.79	57.76				
2.0	1.000	0.625	9	5	13.80	60.39	119.35	4.0	0.625	0.750	12	3	12.85	29.30	56.79				
2.0	1.000	0.625	10	5	13.39	54.79	108.60	4.0	0.625	0.750	13	3	12.84	28.88	55.97				
2.0	1.000	0.750	8	4	12.42	42.60	86.13	4.0	0.625	0.750	14	3	12.99	28.51	55.26				
2.0	1.000	0.750	9	4	12.03	38.36	78.01	4.0	0.750	0.375	15	4	17.60	100.07	194.97				
2.0	1.000	0.750	10	4	11.71	34.41	70.49	4.0	0.750	0.375	16	4	17.17	95.26	185.71				
2.0	1.000	0.750	8	5	12.09	42.29	85.51	4.0	0.750	0.375	17	4	16.77	91.29	178.06				
2.0	1.000	0.750	9	5	11.71	37.86	77.07	4.0	0.750	0.375	18	4	16.41	87.28	170.34				
2.0	1.000	0.750	10	5	11.40	34.10	69.90	4.0	0.750	0.375	15	5	17.45	99.62	194.11				
4.0	0.500	0.500	10	4	22.51	86.00	177.06	4.0	0.750	0.375	16	5	17.02	94.91	185.04				
4.0	0.500	0.500	11	4	22.04	77.27	160.05	4.0	0.750	0.375	17	5	16.63	90.87	177.26				
4.0	0.500	0.500	12	4	21.64	71.09	148.40	4.0	0.750	0.500	18	5	16.27	86.94	169.69				
4.0	0.500	0.500	13	4	21.31	65.11	136.77	4.0	0.750	0.500	10	4	14.84	73.08	143.76				
4.0	0.500	0.500	14	4	21.03	60.60	128.25	4.0	0.750	0.500	11	4	14.31	67.48	133.00				
4.0	0.500	0.625	10	3	19.05	56.21	109.06	4.0	0.750	0.500	12	4	13.86	62.50	123.48				
4.0	0.500	0.625	11	3	18.97	55.29	107.27	4.0	0.750	0.500	13	4	13.46	58.38	115.56				
4.0	0.500	0.625	12	3	19.29	54.53	105.78	4.0	0.750	0.625	10	3	11.41	42.36	86.07				
4.0	0.500	0.625	13	3	19.24	53.88	104.52	4.0	0.750	0.625	11	3	11.08	38.84	79.34				
4.0	0.500	0.625	14	3	19.46	53.33	103.45	4.0	0.750	0.625	12	3	10.80	35.56	73.10				
4.0	0.500	0.750	10	3	20.52	37.11	72.29	4.0	0.750	0.625	13	3	10.57	33.03	68.28				
4.0	0.500	0.750	11	3	20.20	36.67	71.42	4.0	0.750	0.625	14	3	10.37	30.63	63.72				
4.0	0.500	0.750	12	3	20.53	36.31	70.71	4.0	0.875	0.375	11	4	17.12	100.49	194.97				
4.0	0.500	0.750	13	3	20.30	36.00	70.10	4.0	0.875	0.375	12	4	16.61	95.49	185.34				
4.0	0.500	0.750	14	3	20.52	35.73	69.57	4.0	0.875	0.375	13	4	16.14	91.67	177.98				
4.0	0.625	0.375	18	4	19.38	98.60	193.75	4.0	0.875	0.375	14	4	15.72	87.55	170.04				
4.0	0.625	0.375	18	5	19.12	98.02	192.62	4.0	0.875	0.375	15	4	15.33	84.27	163.73				
4.0	0.625	0.500	10	4	17.56	80.67	160.95	4.0	0.875	0.375	16	4	14.97	80.80	157.05				
4.0	0.625	0.500	11	4	17.03	73.56	147.23	4.0	0.875	0.375	17	4	14.63	77.98	151.60				
4.0	0.625	0.500	12	4	16.58	67.78	136.22	4.0	0.875	0.375	18	4	14.32	75.02	145.90				
4.0	0.625	0.500	13	4	16.20	62.74	126.51	4.0	0.875	0.375	11	5	17.01	100.18	194.36				
4.0	0.625	0.500	14	4	15.87	58.46	118.35	4.0	0.875	0.375	12	5	16.51	95.29	184.94				
4.0	0.625	0.625	10	3	13.79	44.54	94.06	4.0	0.875	0.375	13	5	16.05	91.39	177.43				
4.0	0.625	0.625	11	3	13.50	40.46	86.22	4.0	0.875	0.375	14	5	15.62	87.34	169.63				
4.0	0.625	0.625	12	3	13.25	42.18	81.67	4.0	0.875	0.375	15	5	15.24	84.01	163.22				
4.0	0.625	0.625	13	3	13.05	41.37	80.11	4.0	0.875	0.375	16	5	14.88	80.60	156.65				
4.0	0.625	0.625	14	3	12.88	40.68	78.76	4.0	0.875	0.375	17	5	14.54	77.73	151.14				

PLATE AREA - 750.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
4.0	0.875	0.375	18	5	14.24	74.82	145.52
4.0	0.875	0.500	10	4	13.02	64.32	125.61
4.0	0.875	0.500	11	4	12.53	60.10	117.51
4.0	0.875	0.500	12	4	12.11	56.07	109.80
4.0	0.875	0.500	13	4	11.73	52.82	103.57
4.0	0.875	0.500	14	4	11.40	49.69	97.58
4.0	1.000	0.375	10	4	15.16	82.84	160.51
4.0	1.000	0.375	11	4	14.76	80.18	155.39
4.0	1.000	0.375	12	4	14.39	76.89	149.05
4.0	1.000	0.375	13	4	14.04	74.49	144.42
4.0	1.000	0.375	14	4	13.72	71.70	139.05
4.0	1.000	0.375	15	4	13.42	69.55	134.90
4.0	1.000	0.375	16	4	13.13	67.14	130.27
4.0	1.000	0.375	17	4	12.87	65.22	126.56
4.0	1.000	0.375	18	4	12.62	63.12	122.52
4.0	1.000	0.375	10	5	15.10	82.73	160.29
4.0	1.000	0.375	11	5	14.70	80.00	155.03
4.0	1.000	0.375	12	5	14.33	76.77	148.81
4.0	1.000	0.375	13	5	13.98	74.32	144.09
4.0	1.000	0.375	14	5	13.66	71.57	138.80
4.0	1.000	0.375	15	5	13.36	69.39	134.60
4.0	1.000	0.375	16	5	13.08	67.01	130.03
4.0	1.000	0.375	17	5	12.81	65.07	126.28
4.0	1.000	0.375	18	5	12.57	62.99	122.28
4.0	1.000	0.500	10	4	11.98	55.36	107.67
4.0	1.000	0.500	11	4	11.16	52.30	101.80
4.0	1.000	0.500	12	4	10.79	49.19	95.84
4.0	1.000	0.500	13	4	10.46	46.73	91.13
4.0	1.000	0.500	14	4	10.16	44.25	86.37

PLATE AREA - 800.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.750	6	6	36.99	64.88	155.08	1.2	0.500	0.750	8	6	42.00	51.43	136.14
1.0	0.500	0.750	7	6	37.09	64.45	154.04	1.2	0.625	0.625	8	6	29.98	89.38	183.80
1.0	0.500	0.750	6	7	36.90	64.45	154.04	1.2	0.625	0.750	6	5	29.00	71.01	155.01
1.0	0.500	0.750	7	7	36.92	55.16	138.02	1.2	0.625	0.750	7	5	28.83	70.38	147.49
1.0	0.625	0.625	7	7	26.58	94.46	193.60	1.2	0.625	0.750	8	5	28.64	69.87	146.35
1.0	0.625	0.750	6	6	25.19	63.87	138.27	1.2	0.625	0.750	6	6	28.50	70.50	153.82
1.0	0.625	0.750	7	6	25.13	63.31	137.01	1.2	0.625	0.750	7	6	28.36	60.67	135.99
1.0	0.625	0.750	6	7	24.94	63.31	137.01	1.2	0.625	0.750	8	6	28.18	51.98	119.01
1.0	0.625	0.750	7	7	24.86	55.32	122.68	1.2	0.750	0.625	7	6	23.25	99.35	199.29
1.0	0.750	0.625	7	6	20.91	99.10	197.14	1.2	0.750	0.625	8	6	22.88	85.96	173.45
1.0	0.750	0.625	6	7	20.65	99.10	197.14	1.2	0.750	0.750	6	5	21.83	68.67	142.63
1.0	0.750	0.625	7	7	20.40	89.88	179.85	1.2	0.750	0.750	7	5	21.55	66.31	134.43
1.0	0.750	0.750	6	6	18.97	61.58	127.29	1.2	0.750	0.750	8	5	21.32	65.51	132.77
1.0	0.750	0.750	7	6	18.82	60.82	125.67	1.2	0.750	0.750	6	6	21.34	67.92	141.01
1.0	0.750	0.750	6	7	18.63	60.82	125.67	1.2	0.750	0.750	7	6	21.09	59.69	125.86
1.0	0.750	0.750	7	7	18.49	54.10	113.41	1.2	0.750	0.750	8	6	20.87	51.26	109.55
1.0	0.875	0.625	6	6	17.55	93.38	183.92	1.2	0.875	0.625	7	5	19.63	95.07	188.19
1.0	0.875	0.625	7	6	17.24	91.21	179.61	1.2	0.875	0.625	8	5	19.21	93.48	183.13
1.0	0.875	0.625	6	7	17.01	91.21	179.61	1.2	0.875	0.625	7	6	19.05	93.14	184.36
1.0	0.875	0.625	7	7	16.72	84.10	166.24	1.2	0.875	0.625	8	6	18.66	81.32	161.59
1.0	0.875	0.750	6	6	15.29	58.57	118.17	1.2	0.875	0.750	6	5	17.58	65.44	132.42
1.0	0.875	0.750	7	6	15.10	57.57	116.12	1.2	0.875	0.750	7	5	17.25	61.66	122.87
1.0	0.875	0.750	6	7	14.91	57.57	116.12	1.2	0.875	0.750	8	5	16.98	60.58	120.68
1.0	0.875	0.750	7	7	14.74	52.03	105.91	1.2	0.875	0.750	6	6	16.12	64.44	130.35
1.0	0.875	0.625	6	6	15.14	85.33	167.09	1.2	0.875	0.750	7	6	16.81	57.62	117.69
1.0	1.000	0.625	7	6	14.81	83.00	162.50	1.2	0.875	0.750	8	6	16.55	49.76	102.54
1.0	1.000	0.625	6	7	14.62	83.00	162.50	1.2	1.000	0.625	6	5	17.35	95.08	186.30
1.0	1.000	0.625	7	7	14.32	77.66	152.44	1.2	1.000	0.625	7	5	16.82	88.02	172.93
1.0	1.000	0.750	6	6	12.92	55.11	109.57	1.2	1.000	0.625	8	5	16.39	83.31	162.56
1.0	1.000	0.750	7	6	12.70	53.91	107.26	1.2	1.000	0.625	6	6	16.79	92.74	181.69
1.0	1.000	0.750	6	7	12.53	53.91	107.26	1.2	1.000	0.625	7	6	16.30	85.98	168.90
1.0	1.000	0.750	7	7	12.34	49.42	98.92	1.2	1.000	0.625	8	6	15.90	75.86	149.41
1.2	0.500	0.750	6	5	42.57	71.85	174.45	1.2	1.000	0.750	6	5	14.84	61.62	122.84
1.2	0.500	0.750	7	5	42.58	73.17	164.76	1.2	1.000	0.750	7	5	14.48	55.91	112.17
1.2	0.500	0.750	8	5	42.45	72.89	164.04	1.2	1.000	0.750	8	5	14.19	55.53	109.55
1.2	0.500	0.750	6	6	42.06	71.52	173.58	1.2	1.000	0.750	6	6	14.40	60.41	120.39
1.2	0.500	0.750	7	6	42.12	59.96	153.21	1.2	1.000	0.750	7	6	14.07	54.83	109.98
1.2	0.500	0.750	6	6				1.2	1.000	0.750	8	6	13.80	47.70	96.28

PLATE AREA - 800.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.4	0.500	0.750	7	5	43.51	61.86	159.53	1.6	0.500	0.750	7	6	41.87	61.16	158.31
1.4	0.500	0.750	8	5	43.31	53.29	142.56	1.6	0.500	0.750	8	6	41.62	53.05	142.49
1.4	0.500	0.750	7	6	43.16	61.66	159.01	1.6	0.500	0.750	9	6	41.43	45.48	128.26
1.4	0.500	0.750	8	6	42.97	53.15	142.14	1.6	0.625	0.625	8	5	30.28	92.45	192.94
1.4	0.625	0.625	8	5	31.14	98.45	196.14	1.6	0.625	0.625	9	5	29.85	81.65	172.39
1.4	0.625	0.625	8	6	30.66	92.22	192.19	1.6	0.625	0.625	8	6	29.92	92.00	191.97
1.4	0.625	0.750	7	5	29.43	62.83	141.52	1.6	0.625	0.625	9	6	29.49	81.19	171.42
1.4	0.625	0.750	8	5	29.16	53.99	124.31	1.6	0.625	0.750	7	5	28.59	62.36	140.69
1.4	0.625	0.750	7	6	29.08	62.45	140.66	1.6	0.625	0.750	8	5	28.26	53.83	124.21
1.4	0.625	0.750	8	6	28.82	53.73	123.68	1.6	0.625	0.750	9	5	28.00	46.94	111.22
1.4	0.750	0.625	8	5	23.85	89.47	180.79	1.6	0.625	0.750	7	6	28.32	62.02	139.97
1.4	0.750	0.625	8	6	23.40	88.55	178.90	1.6	0.625	0.750	8	6	27.99	53.65	123.77
1.4	0.750	0.750	7	5	21.98	62.05	131.16	1.6	0.625	0.750	9	6	27.74	46.73	110.73
1.4	0.750	0.750	8	5	21.66	53.34	114.36	1.6	0.750	0.625	8	5	23.29	88.93	179.77
1.4	0.750	0.750	7	6	21.64	61.49	129.99	1.6	0.750	0.625	9	5	22.80	79.65	162.10
1.4	0.750	0.750	8	6	21.33	52.96	113.50	1.6	0.750	0.625	8	6	22.95	88.29	178.46
1.4	0.875	0.625	7	5	20.06	97.14	192.38	1.6	0.750	0.625	9	6	22.48	79.02	160.81
1.4	0.875	0.625	8	5	19.52	84.69	168.41	1.6	0.750	0.750	7	5	21.44	61.60	130.32
1.4	0.875	0.625	7	6	19.63	95.69	189.50	1.6	0.750	0.750	8	5	21.05	53.15	114.05
1.4	0.875	0.625	8	6	19.11	83.56	166.13	1.6	0.750	0.750	9	5	20.75	46.97	102.37
1.4	0.875	0.750	7	5	17.60	60.07	122.85	1.6	0.750	0.750	7	6	21.18	61.16	129.40
1.4	0.875	0.750	8	5	17.24	51.85	107.04	1.6	0.750	0.750	8	6	20.80	52.88	113.46
1.4	0.875	0.750	7	6	17.27	59.37	121.42	1.6	0.750	0.750	9	6	20.51	46.67	101.74
1.4	0.875	0.750	8	6	16.93	51.34	105.96	1.6	0.875	0.625	7	5	19.78	96.21	190.55
1.4	1.000	0.625	7	5	17.23	89.66	176.16	1.6	0.875	0.625	8	5	19.15	83.99	167.03
1.4	1.000	0.625	8	5	16.69	78.93	155.52	1.6	0.875	0.625	9	5	18.64	76.17	152.11
1.4	1.000	0.625	7	6	16.83	88.11	173.12	1.6	0.875	0.625	7	6	19.46	95.13	188.41
1.4	1.000	0.625	8	6	16.32	77.69	153.06	1.6	0.875	0.625	8	6	18.84	83.19	165.42
1.4	1.000	0.750	7	5	14.79	57.26	114.92	1.6	0.875	0.625	9	6	18.35	75.43	150.61
1.4	1.000	0.750	8	5	14.41	49.74	100.50	1.6	0.875	0.750	7	5	17.23	59.64	121.99
1.4	1.000	0.750	7	6	14.48	56.44	113.29	1.6	0.875	0.750	8	5	16.81	51.60	106.56
1.4	1.000	0.750	8	6	14.12	49.12	99.22	1.6	0.975	0.750	9	5	16.48	46.13	95.21
1.6	0.500	0.625	9	5	43.19	92.47	187.67	1.6	0.975	0.750	7	6	16.99	59.10	120.91
1.6	0.500	0.625	9	6	42.81	81.45	186.37	1.6	0.975	0.750	8	6	16.58	51.24	105.81
1.6	0.500	0.750	7	5	42.15	61.37	158.80	1.6	1.000	0.625	9	6	16.26	45.77	95.45
1.6	0.500	0.750	8	5	41.89	53.15	142.79	1.6	1.000	0.625	8	5	17.07	98.61	174.08
1.6	0.500	0.750	9	5	41.70	45.61	128.60	1.6	1.000	0.625	9	5	16.45	78.06	153.80
								1.6	1.000	0.625	9	5	15.94	71.61	141.48

PLATE AREA - 800.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	1.000	0.625	7	6	16.77	87.45	171.81	1.8	1.000	0.750	9	5	13.17	43.36	88.14
1.6	1.000	0.625	8	6	16.17	77.17	152.03	2.0	0.500	0.625	8	5	38.38	89.04	199.37
1.6	1.000	0.625	9	6	15.68	70.80	139.87	2.0	0.500	0.625	9	5	37.95	76.35	174.82
1.6	1.000	0.750	7	5	14.55	56.80	113.99	2.0	0.500	0.625	10	5	37.62	68.80	160.46
1.6	1.000	0.750	8	5	14.11	49.41	99.83	2.0	0.500	0.750	8	4	38.20	51.00	136.33
1.6	1.000	0.750	9	5	13.76	44.64	90.79	2.0	0.500	0.750	9	4	37.95	44.06	122.21
1.6	1.000	0.750	7	6	14.32	56.19	112.77	2.0	0.500	0.750	10	4	37.75	39.10	113.24
1.6	1.000	0.750	8	6	13.89	48.98	98.94	2.0	0.500	0.750	8	5	37.50	50.42	135.32
1.6	1.000	0.750	9	6	13.55	44.22	89.94	2.0	0.500	0.750	9	5	37.29	42.65	119.97
1.8	0.500	0.625	9	5	40.74	79.36	181.78	2.0	0.500	0.750	10	5	37.64	38.36	112.03
1.8	0.500	0.625	10	5	40.43	71.29	166.21	2.0	0.625	0.625	8	5	27.04	87.45	182.51
1.8	0.500	0.750	7	5	39.71	59.68	154.47	2.0	0.625	0.625	9	5	26.52	76.33	161.14
1.8	0.500	0.750	8	5	39.42	52.02	139.84	2.0	0.625	0.625	10	5	26.12	68.63	146.40
1.8	0.500	0.750	9	5	39.21	44.32	124.98	2.0	0.625	0.750	8	4	25.92	51.50	118.49
1.8	0.625	0.625	8	5	28.77	90.36	188.63	2.0	0.625	0.750	9	4	25.61	45.04	105.81
1.8	0.625	0.625	9	5	28.29	79.32	167.52	2.0	0.625	0.750	10	4	25.36	40.07	96.53
1.8	0.625	0.625	10	5	27.91	71.11	151.74	2.0	0.625	0.750	8	5	24.91	51.04	117.64
1.8	0.625	0.750	7	5	27.07	60.69	136.90	2.0	0.625	0.750	9	5	24.60	43.92	103.88
1.8	0.625	0.750	8	5	26.69	52.68	121.55	2.0	0.625	0.750	10	5	24.36	39.47	95.47
1.8	0.625	0.750	9	5	26.41	45.62	108.09	2.0	0.750	0.625	8	5	21.09	83.93	169.62
1.8	0.750	0.625	8	5	22.27	86.82	175.51	2.0	0.750	0.625	9	5	20.93	74.41	151.37
1.8	0.750	0.625	9	5	21.74	77.35	157.41	2.0	0.750	0.625	10	5	20.08	66.94	137.04
1.8	0.750	0.625	10	5	21.31	69.42	142.17	2.0	0.750	0.750	8	4	19.45	50.73	108.64
1.8	0.750	0.750	7	5	20.42	60.00	126.88	2.0	0.750	0.750	9	4	19.08	44.84	97.24
1.8	0.750	0.750	8	5	19.98	51.98	111.53	2.0	0.750	0.750	10	4	18.80	39.95	88.01
1.8	0.750	0.750	9	5	19.65	45.66	99.48	2.0	0.750	0.750	8	5	18.77	50.34	107.91
1.8	0.875	0.625	8	5	18.44	81.86	162.76	2.0	0.750	0.750	9	5	18.41	43.96	95.68
1.8	0.875	0.625	9	5	17.88	73.90	147.54	2.0	0.750	0.750	10	5	18.13	39.47	87.13
1.8	0.875	0.625	10	5	17.43	66.58	133.46	2.0	0.875	0.625	8	5	17.59	79.00	157.01
1.8	0.875	0.750	7	5	16.52	58.09	118.78	2.0	0.875	0.625	9	5	17.01	71.03	141.75
1.8	0.875	0.750	8	5	16.05	50.43	104.10	2.0	0.875	0.625	10	5	16.53	64.10	128.46
1.8	0.875	0.750	9	5	15.69	44.84	93.47	2.0	0.875	0.750	8	4	15.66	49.15	101.33
1.8	1.000	0.625	8	5	15.93	75.90	149.50	2.0	0.875	0.750	9	4	15.26	43.86	91.16
1.8	1.000	0.625	9	5	15.38	69.36	137.00	2.0	0.875	0.750	10	4	14.94	39.18	82.28
1.8	1.000	0.625	10	5	14.93	62.84	124.46	2.0	0.875	0.750	8	5	15.18	48.79	100.65
1.8	1.000	0.750	7	5	14.04	55.30	110.93	2.0	0.875	0.750	9	5	14.79	43.17	89.90
1.8	1.000	0.750	8	5	13.55	48.23	97.39	2.0	0.875	0.750	10	5	14.48	38.78	81.54

PLATE AREA - 800.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
2.0	1.000	0.500	10	5	17.84	100.59	196.22	4.0	0.750	0.375	17	5	17.73	100.11	195.22
2.0	1.000	0.625	8	5	15.30	73.07	143.87	4.0	0.750	0.375	18	5	17.35	95.78	186.88
2.0	1.000	0.625	9	5	14.72	66.56	131.40	4.0	0.750	0.375	19	5	17.00	92.04	179.66
2.0	1.000	0.625	10	5	14.24	60.39	119.56	4.0	0.750	0.500	11	4	15.27	74.33	146.37
2.0	1.000	0.750	8	4	13.26	46.96	94.73	4.0	0.750	0.500	12	4	14.78	68.85	135.89
2.0	1.000	0.750	9	4	12.84	42.29	85.79	4.0	0.750	0.500	13	4	14.36	64.31	127.15
2.0	1.000	0.750	10	4	12.50	37.93	77.48	4.0	0.750	0.500	14	4	14.00	60.16	119.22
2.0	1.000	0.750	8	5	12.90	46.61	94.05	4.0	0.750	0.625	11	4	12.10	42.09	35.72
2.0	1.000	0.750	9	5	12.49	41.72	84.74	4.0	0.750	0.625	12	4	11.80	38.75	79.40
2.0	1.000	0.750	10	5	12.16	37.58	76.82	4.0	0.750	0.625	14	4	11.32	33.33	57.06
4.0	0.500	0.500	11	4	23.53	85.13	175.72	4.0	0.750	0.750	11	3	10.00	25.84	56.24
4.0	0.500	0.500	12	4	23.11	78.33	162.89	4.0	0.875	0.375	13	4	17.22	101.00	196.07
4.0	0.500	0.500	13	4	22.75	71.74	150.07	4.0	0.875	0.375	14	4	16.77	96.45	187.31
4.0	0.500	0.500	14	4	22.45	66.77	140.68	4.0	0.875	0.375	15	4	16.35	92.84	180.36
4.0	0.500	0.625	11	4	20.41	43.72	100.95	4.0	0.875	0.375	16	4	15.96	89.02	173.00
4.0	0.500	0.625	12	4	20.19	40.26	94.77	4.0	0.875	0.375	17	4	15.61	85.91	167.00
4.0	0.500	0.625	13	4	20.00	36.47	87.13	4.0	0.875	0.375	18	4	15.28	82.65	160.72
4.0	0.500	0.625	14	4	19.85	42.68	82.90	4.0	0.875	0.375	19	4	14.97	79.93	155.49
4.0	0.500	0.750	11	3	21.47	40.67	79.19	4.0	0.875	0.375	13	5	17.12	100.68	195.47
4.0	0.500	0.750	12	3	21.82	40.27	78.41	4.0	0.875	0.375	14	5	16.67	96.22	186.87
4.0	0.500	0.750	13	3	21.58	39.94	77.76	4.0	0.875	0.375	15	5	16.25	92.55	179.81
4.0	0.500	0.750	14	3	21.82	39.65	77.19	4.0	0.875	0.375	16	5	15.87	88.79	172.56
4.0	0.625	0.500	11	4	18.17	81.03	161.91	4.0	0.875	0.375	17	5	15.51	85.64	166.48
4.0	0.625	0.500	12	4	17.70	74.67	149.78	4.0	0.875	0.375	18	5	15.19	82.43	160.29
4.0	0.625	0.500	13	4	17.29	69.11	139.08	4.0	0.875	0.375	19	5	14.88	79.69	155.01
4.0	0.625	0.500	14	4	16.94	64.40	130.08	4.0	0.875	0.500	11	4	13.37	66.20	129.38
4.0	0.625	0.625	11	4	14.97	43.60	92.40	4.0	0.875	0.500	12	4	12.92	61.76	120.88
4.0	0.625	0.625	12	4	14.70	40.08	85.84	4.0	0.875	0.500	13	4	12.52	58.18	114.02
4.0	0.625	0.625	13	4	14.47	36.72	79.28	4.0	0.875	0.500	14	4	12.17	54.74	107.42
4.0	0.625	0.625	14	4	14.28	34.15	74.49	4.0	0.875	0.625	11	4	10.38	39.61	79.02
4.0	0.625	0.750	11	3	13.41	33.02	64.01	4.0	0.875	0.625	12	4	10.07	36.60	73.30
4.0	0.625	0.750	12	3	13.65	32.47	62.96	4.0	1.000	0.375	11	4	15.74	88.34	171.21
4.0	0.625	0.750	13	3	13.64	32.02	62.07	4.0	1.000	0.375	12	4	15.35	84.71	164.22
4.0	0.625	0.750	14	3	13.80	31.62	61.30	4.0	1.000	0.375	13	4	14.98	82.07	159.12
4.0	0.750	0.375	17	4	17.89	100.57	196.10	4.0	1.000	0.375	14	4	14.63	78.99	153.19
4.0	0.750	0.375	18	4	17.51	96.16	187.60	4.0	1.000	0.375	15	4	14.31	76.62	148.62
4.0	0.750	0.375	19	4	17.15	92.46	180.47	4.0	1.000	0.375	16	4	14.01	73.97	143.52

PLATE AREA - 800.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
4.0	1.000	0.375	17	4	13.73	71.85	139.43
4.0	1.000	0.375	18	4	13.46	69.54	134.97
4.0	1.000	0.375	19	4	13.21	67.64	131.31
4.0	1.000	0.375	11	5	15.68	88.14	170.82
4.0	1.000	0.375	12	5	15.28	84.58	163.95
4.0	1.000	0.375	13	5	14.91	81.88	158.76
4.0	1.000	0.375	14	5	14.57	78.85	152.92
4.0	1.000	0.375	15	5	14.25	76.45	148.29
4.0	1.000	0.375	16	5	13.95	73.83	143.25
4.0	1.000	0.375	17	5	13.67	71.69	139.12
4.0	1.000	0.375	18	5	13.40	69.40	134.72
4.0	1.000	0.375	19	5	13.15	67.49	131.02
4.0	1.000	0.500	11	4	11.91	57.61	112.13
4.0	1.000	0.500	12	4	11.51	54.18	105.55
4.0	1.000	0.500	13	4	11.16	51.47	100.36
4.0	1.000	0.500	14	4	10.84	48.74	95.11

PLATE AREA - 850.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.0	0.500	0.750	6	6	39.25	71.28	168.54	1.2	0.625	0.750	6	7	30.05	76.91	166.72	1.2	0.625	0.750	6
1.0	0.500	0.750	7	6	39.37	70.80	167.39	1.2	0.625	0.750	7	7	29.90	66.36	147.54	1.2	0.625	0.750	7
1.0	0.500	0.750	6	7	39.18	70.80	167.39	1.2	0.625	0.750	8	7	29.70	56.82	128.91	1.2	0.625	0.750	8
1.0	0.500	0.750	7	7	39.20	60.61	149.69	1.2	0.750	0.625	8	6	24.30	94.25	189.76	1.2	0.750	0.625	8
1.0	0.500	0.750	6	6	26.74	70.11	150.87	1.2	0.750	0.625	8	7	23.90	93.20	187.61	1.2	0.750	0.625	8
1.0	0.625	0.750	7	6	26.68	69.49	149.49	1.2	0.750	0.750	6	6	22.66	74.49	154.09	1.2	0.750	0.750	6
1.0	0.625	0.750	6	7	26.48	69.49	149.49	1.2	0.750	0.750	7	6	22.40	65.46	137.41	1.2	0.750	0.750	7
1.0	0.625	0.750	7	7	26.40	60.72	133.70	1.2	0.750	0.750	8	6	22.16	56.23	119.55	1.2	0.750	0.750	8
1.0	0.750	0.625	7	7	21.67	98.57	196.90	1.2	0.750	0.750	6	7	22.38	73.87	152.77	1.2	0.750	0.750	6
1.0	0.750	0.750	6	6	20.14	67.56	139.17	1.2	0.750	0.750	7	7	22.13	64.98	136.36	1.2	0.750	0.750	7
1.0	0.750	0.750	7	6	19.99	66.72	137.40	1.2	0.750	0.750	8	7	21.90	55.82	118.63	1.2	0.750	0.750	8
1.0	0.750	0.750	6	7	19.78	66.72	137.40	1.2	0.875	0.625	8	6	19.82	89.16	176.91	1.2	0.875	0.625	8
1.0	0.750	0.750	7	7	19.64	59.36	123.91	1.2	0.875	0.625	7	7	19.82	100.52	198.71	1.2	0.875	0.625	7
1.0	0.875	0.625	7	6	18.32	100.01	196.77	1.2	0.875	0.625	8	7	19.41	87.84	174.27	1.2	0.875	0.625	8
1.0	0.875	0.625	6	7	18.08	100.01	196.77	1.2	0.875	0.750	6	6	18.18	70.66	142.60	1.2	0.875	0.750	6
1.0	0.875	0.750	7	7	17.77	92.22	182.09	1.2	0.875	0.750	7	6	17.85	63.18	128.69	1.2	0.875	0.750	7
1.0	0.875	0.750	6	6	16.24	64.24	129.33	1.2	0.875	0.750	8	6	17.58	54.56	112.08	1.2	0.875	0.750	8
1.0	0.875	0.750	7	6	16.04	63.15	127.09	1.2	0.875	0.750	6	7	17.87	69.83	140.89	1.2	0.875	0.750	6
1.0	0.875	0.750	6	7	15.84	63.15	127.09	1.2	0.875	0.750	7	7	17.56	62.48	127.23	1.2	0.875	0.750	7
1.0	0.875	0.750	7	7	15.65	57.08	115.87	1.2	0.875	0.750	8	7	17.30	53.99	110.86	1.2	0.875	0.750	8
1.0	1.000	0.625	6	6	16.08	93.55	183.08	1.2	1.000	0.625	7	6	17.32	94.25	185.01	1.2	1.000	0.625	7
1.0	1.000	0.625	7	6	15.74	90.99	178.06	1.2	1.000	0.625	8	6	16.90	83.15	163.64	1.2	1.000	0.625	8
1.0	1.000	0.625	6	7	15.53	90.99	178.06	1.2	1.000	0.625	7	7	16.91	92.48	181.53	1.2	1.000	0.625	7
1.0	1.000	0.625	7	7	15.22	89.15	167.03	1.2	1.000	0.625	8	7	16.51	81.67	160.71	1.2	1.000	0.625	8
1.0	1.000	0.750	6	6	13.72	60.44	120.10	1.2	1.000	0.750	6	6	15.30	66.23	131.80	1.2	1.000	0.750	6
1.0	1.000	0.750	7	6	13.50	59.13	117.46	1.2	1.000	0.750	7	6	14.94	60.12	120.36	1.2	1.000	0.750	7
1.0	1.000	0.750	6	7	13.32	59.13	117.46	1.2	1.000	0.750	8	6	14.66	52.30	105.34	1.2	1.000	0.750	8
1.0	1.000	0.750	7	7	13.11	54.21	108.31	1.2	1.000	0.750	6	7	14.98	65.21	129.74	1.2	1.000	0.750	6
1.2	0.500	0.750	6	6	44.64	78.55	188.46	1.2	1.000	0.750	8	7	14.64	59.24	118.59	1.2	1.000	0.750	7
1.2	0.500	0.750	7	6	44.72	65.84	155.95	1.2	1.000	0.750	8	7	14.37	51.59	103.87	1.2	1.000	0.750	8
1.2	0.500	0.750	8	6	44.59	56.52	147.33	1.4	0.500	0.750	7	5	46.20	67.90	172.70	1.4	0.500	0.750	7
1.2	0.500	0.750	6	7	44.59	78.21	187.64	1.4	0.500	0.750	8	5	45.99	58.55	154.21	1.4	0.500	0.750	8
1.2	0.500	0.750	7	7	44.58	66.05	166.15	1.4	0.500	0.750	9	5	45.83	68.67	150.54	1.4	0.500	0.750	9
1.2	0.500	0.750	8	7	44.44	56.48	147.07	1.4	0.500	0.750	7	6	45.83	67.70	172.18	1.4	0.500	0.750	7
1.2	0.500	0.750	6	6	30.26	77.35	167.73	1.4	0.500	0.750	8	6	45.62	58.40	153.77	1.4	0.500	0.750	8
1.2	0.625	0.750	7	6	30.12	66.55	148.07	1.4	0.500	0.750	9	6	45.46	50.45	139.15	1.4	0.500	0.750	9
1.2	0.625	0.750	8	6	29.92	57.05	129.50	1.4	0.625	0.625	9	6	32.20	89.84	188.56	1.4	0.625	0.625	9

PLATE AREA - 850.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB
1.4	0.625	0.750	7	5	31.25	68.90	154.01	1.6	0.500	0.750	7	5	44.76	67.36	171.93	1.6	0.500	0.750	7
1.4	0.625	0.750	8	5	30.97	65.83	136.01	1.6	0.500	0.750	8	5	44.49	58.39	154.47	1.6	0.500	0.750	8
1.4	0.625	0.750	9	5	30.75	65.38	135.04	1.6	0.500	0.750	9	5	44.29	50.10	138.85	1.6	0.500	0.750	9
1.4	0.625	0.750	7	6	30.88	68.49	153.10	1.6	0.500	0.750	7	6	44.47	67.14	171.44	1.6	0.500	0.750	7
1.4	0.625	0.750	8	6	30.60	58.96	134.54	1.6	0.500	0.750	8	6	44.20	58.28	154.15	1.6	0.500	0.750	8
1.4	0.625	0.750	9	6	30.39	51.72	121.06	1.6	0.500	0.750	9	6	44.00	49.97	138.51	1.6	0.500	0.750	9
1.4	0.750	0.625	8	5	25.34	98.08	197.75	1.6	0.625	0.625	9	5	31.71	89.51	188.13	1.6	0.625	0.625	9
1.4	0.750	0.625	9	5	24.90	96.44	189.64	1.6	0.625	0.625	9	6	31.33	89.02	187.09	1.6	0.625	0.625	9
1.4	0.750	0.625	8	6	24.86	97.07	195.67	1.6	0.625	0.750	7	5	30.37	68.37	153.10	1.6	0.625	0.750	7
1.4	0.750	0.625	9	6	24.45	87.42	177.33	1.6	0.625	0.750	8	5	30.01	59.06	135.09	1.6	0.625	0.750	8
1.4	0.750	0.750	7	5	23.35	68.02	143.15	1.6	0.625	0.750	7	6	29.74	51.49	120.81	1.6	0.625	0.750	7
1.4	0.750	0.750	8	5	23.01	58.50	124.76	1.6	0.625	0.750	7	6	30.08	68.02	152.34	1.6	0.625	0.750	7
1.4	0.750	0.750	9	5	22.75	60.93	122.46	1.6	0.625	0.750	8	6	29.73	58.86	134.62	1.6	0.625	0.750	8
1.4	0.750	0.750	7	6	22.99	67.42	141.88	1.6	0.625	0.750	9	6	29.47	51.27	120.30	1.6	0.625	0.750	9
1.4	0.750	0.750	8	6	22.66	58.08	123.83	1.6	0.750	0.625	8	5	24.74	97.47	196.61	1.6	0.750	0.625	8
1.4	0.750	0.750	9	6	22.40	51.61	111.69	1.6	0.750	0.625	9	5	24.23	87.30	177.20	1.6	0.750	0.625	9
1.4	0.875	0.625	8	5	20.74	92.83	184.34	1.6	0.750	0.625	8	6	24.39	96.77	195.17	1.6	0.750	0.625	8
1.4	0.875	0.625	9	5	20.28	84.61	168.66	1.6	0.750	0.625	9	6	23.89	86.61	175.81	1.6	0.750	0.625	9
1.4	0.875	0.625	8	6	20.30	91.59	181.85	1.6	0.750	0.750	7	5	22.77	67.52	142.21	1.6	0.750	0.750	7
1.4	0.875	0.625	9	6	19.86	83.49	166.42	1.6	0.750	0.750	8	5	22.36	58.28	124.41	1.6	0.750	0.750	8
1.4	0.875	0.750	7	5	18.69	65.84	134.29	1.6	0.750	0.750	9	5	22.04	51.49	111.58	1.6	0.750	0.750	9
1.4	0.875	0.750	8	5	18.31	56.84	116.97	1.6	0.750	0.750	7	6	22.50	67.04	141.22	1.6	0.750	0.750	7
1.4	0.875	0.750	9	5	18.02	56.04	111.07	1.6	0.750	0.750	8	6	22.09	57.98	123.77	1.6	0.750	0.750	8
1.4	0.875	0.750	7	6	18.35	65.08	132.73	1.6	0.875	0.625	9	6	21.78	51.17	110.89	1.6	0.875	0.625	9
1.4	0.875	0.750	8	6	17.98	56.28	115.79	1.6	0.875	0.625	8	5	20.34	92.05	182.80	1.6	0.875	0.625	8
1.4	0.875	0.750	9	6	17.70	50.58	109.05	1.6	0.875	0.625	9	5	19.81	83.48	166.44	1.6	0.875	0.625	9
1.4	1.000	0.625	7	5	18.30	98.26	192.93	1.6	0.875	0.625	8	6	20.02	91.17	181.05	1.6	0.875	0.625	8
1.4	1.000	0.625	8	5	17.73	86.51	170.31	1.6	0.875	0.625	9	6	19.50	82.66	164.80	1.6	0.875	0.625	9
1.4	1.000	0.625	9	5	17.26	79.70	157.31	1.6	0.875	0.750	7	5	18.31	65.36	133.33	1.6	0.875	0.750	7
1.4	1.000	0.625	7	6	17.89	96.57	189.60	1.6	0.875	0.750	8	5	17.86	56.56	116.43	1.6	0.875	0.750	8
1.4	1.000	0.625	8	6	17.34	85.15	167.61	1.6	0.875	0.750	9	5	17.51	50.56	105.07	1.6	0.875	0.750	9
1.4	1.000	0.625	9	6	16.89	78.49	154.91	1.6	0.875	0.750	7	6	18.05	64.77	132.15	1.6	0.875	0.750	7
1.4	1.000	0.750	7	5	15.71	62.76	125.74	1.6	0.875	0.750	8	6	17.61	56.17	115.61	1.6	0.875	0.750	8
1.4	1.000	0.750	8	5	15.31	54.53	109.92	1.6	0.875	0.750	9	6	17.27	50.17	104.24	1.6	0.875	0.750	9
1.4	1.000	0.750	9	5	15.00	51.18	100.61	1.6	1.000	0.625	7	5	18.14	97.10	190.63	1.6	1.000	0.625	7
1.4	1.000	0.750	7	6	15.38	61.87	123.95	1.6	1.000	0.625	8	5	17.47	95.95	168.40	1.6	1.000	0.625	8
1.4	1.000	0.750	8	6	15.00	53.85	108.53	1.6	1.000	0.625	9	5	16.94	78.48	154.89	1.6	1.000	0.625	9
1.4	1.000	0.750	9	6	14.70	48.89	99.17	1.6	1.000	0.625	7	6	17.82	95.84	188.15	1.6	1.000	0.625	7

PLATE AREA - 850.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	1.000	0.625	8	6	17.18	84.57	166.46	2.0	0.500	0.625	9	5	40.32	83.74	190.13
1.6	1.000	0.625	9	6	16.66	77.59	153.13	2.0	0.500	0.625	10	5	39.97	75.48	174.42
1.6	1.000	0.750	7	5	15.46	62.24	124.70	2.0	0.500	0.750	8	5	39.10	55.38	146.44
1.6	1.000	0.750	8	5	14.99	54.16	109.19	2.0	0.500	0.750	9	5	38.89	46.85	129.62
1.6	1.000	0.750	9	5	14.62	48.93	99.26	2.0	0.500	0.750	10	5	39.26	42.16	120.93
1.6	1.000	0.750	7	6	15.21	61.58	123.37	2.0	0.625	0.625	8	5	28.73	95.86	199.29
1.6	1.000	0.750	8	6	14.76	53.68	108.21	2.0	0.625	0.625	9	5	28.18	83.66	175.85
1.6	1.000	0.750	9	6	14.40	48.47	98.33	2.0	0.625	0.625	10	5	27.79	75.24	159.71
1.8	0.500	0.625	9	5	43.28	87.04	197.69	2.0	0.625	0.750	8	5	26.47	55.98	127.97
1.8	0.500	0.625	10	5	42.95	89.92	180.76	2.0	0.625	0.750	9	5	26.14	48.17	112.88
1.8	0.500	0.750	8	5	41.87	57.15	151.31	2.0	0.750	0.750	10	5	23.88	43.30	103.67
1.8	0.500	0.750	9	5	41.63	48.69	134.99	2.0	0.750	0.625	8	5	22.42	91.98	185.48
1.8	0.500	0.750	10	5	41.45	43.63	125.38	2.0	0.750	0.625	9	5	21.82	81.54	165.46
1.8	0.625	0.625	9	5	30.06	86.95	182.81	2.0	0.750	0.750	8	5	21.34	73.36	149.76
1.8	0.625	0.625	10	5	29.65	77.97	165.53	2.0	0.750	0.750	9	5	19.94	55.19	117.71
1.8	0.625	0.750	8	5	28.36	57.78	132.21	2.0	0.750	0.750	9	5	19.56	48.18	104.29
1.8	0.625	0.750	9	5	28.05	50.04	117.43	2.0	0.875	0.625	10	5	19.26	43.27	94.93
1.8	0.625	0.750	10	5	27.81	44.83	107.45	2.0	0.875	0.625	8	5	18.69	86.56	171.82
1.8	0.750	0.625	8	5	23.67	95.15	191.93	2.0	0.875	0.625	9	5	18.07	77.83	155.08
1.8	0.750	0.625	9	5	23.10	84.77	172.07	2.0	0.875	0.750	10	5	17.57	70.24	140.52
1.8	0.750	0.625	10	5	22.65	76.09	155.38	2.0	0.875	0.750	8	5	16.13	53.47	109.96
1.8	0.750	0.750	8	5	21.23	56.99	121.66	2.0	0.875	0.750	9	5	15.71	47.30	98.17
1.8	0.750	0.750	9	5	20.88	50.05	108.43	2.0	0.875	0.750	10	5	15.38	42.51	89.01
1.8	0.750	0.750	10	5	20.60	44.81	98.41	2.0	1.000	0.625	8	5	16.25	80.06	157.51
1.8	0.875	0.625	8	5	19.59	89.70	178.12	2.0	1.000	0.625	9	5	15.64	72.92	143.84
1.8	0.875	0.625	9	5	19.00	80.98	161.43	2.0	1.000	0.625	10	5	15.14	66.16	130.86
1.8	0.875	0.625	10	5	18.52	72.96	146.00	2.0	1.000	0.750	8	5	13.70	51.07	102.85
1.8	0.875	0.750	8	5	17.06	55.27	113.74	2.0	1.000	0.750	9	5	13.27	45.72	92.63
1.8	0.875	0.750	9	5	16.67	49.14	102.07	2.0	1.000	0.750	10	5	12.93	41.18	83.97
1.8	0.875	0.750	10	5	16.36	44.05	92.32	4.0	0.500	0.500	11	4	25.01	93.24	191.87
1.8	1.000	0.625	8	5	16.93	83.17	163.68	4.0	0.500	0.500	12	4	24.57	85.80	177.81
1.8	1.000	0.625	9	5	16.34	76.00	149.97	4.0	0.500	0.500	13	4	24.19	78.59	163.77
1.8	1.000	0.625	10	5	15.86	68.86	136.23	4.0	0.500	0.500	14	4	23.87	73.15	153.49
1.8	1.000	0.750	8	5	14.40	52.85	106.51	4.0	0.500	0.500	15	4	23.59	67.90	143.27
1.8	1.000	0.750	9	5	13.99	47.52	96.36	4.0	0.500	0.625	11	4	21.71	47.90	109.77
1.8	1.000	0.750	10	5	13.66	42.72	87.17	4.0	0.500	0.625	12	4	21.48	44.12	103.00

PLATE AREA - 850.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
4.0	0.500	0.625	13	4	21.28	39.96	94.63	4.0	0.750	0.750	13	4	10.63	23.29	51.57
4.0	0.500	0.625	14	4	21.11	46.94	91.16	4.0	0.750	0.750	14	4	10.49	21.65	48.53
4.0	0.500	0.625	15	4	20.97	46.55	90.41	4.0	0.750	0.750	15	4	10.36	20.10	45.51
4.0	0.500	0.750	11	4	21.57	26.92	74.54	4.0	0.875	0.375	15	4	17.37	101.69	197.53
4.0	0.500	0.750	12	4	22.30	24.80	71.17	4.0	0.875	0.375	16	4	16.96	97.50	189.46
4.0	0.500	0.750	13	4	21.70	22.24	65.58	4.0	0.875	0.375	17	4	16.58	94.09	182.88
4.0	0.500	0.750	14	4	22.20	20.69	63.09	4.0	0.875	0.375	18	4	16.23	90.52	176.00
4.0	0.500	0.750	15	4	21.76	30.49	59.50	4.0	0.875	0.375	19	4	15.91	87.55	170.28
4.0	0.625	0.500	11	4	19.32	88.73	177.05	4.0	0.875	0.375	20	4	15.60	84.46	164.33
4.0	0.625	0.500	12	4	18.81	81.77	163.76	4.0	0.875	0.375	15	5	17.27	101.37	196.92
4.0	0.625	0.500	13	4	18.38	75.69	152.03	4.0	0.875	0.375	16	5	16.86	97.25	188.98
4.0	0.625	0.500	14	4	18.01	70.53	142.18	4.0	0.875	0.375	17	5	16.48	93.80	182.32
4.0	0.625	0.500	15	4	17.69	66.00	133.44	4.0	0.875	0.375	18	5	16.14	90.28	175.54
4.0	0.625	0.625	11	4	15.92	47.74	100.78	4.0	0.875	0.375	19	5	15.81	87.28	169.75
4.0	0.625	0.625	12	4	15.63	43.90	93.60	4.0	0.875	0.375	20	5	15.51	84.23	163.89
4.0	0.625	0.625	13	4	15.39	40.21	86.42	4.0	0.875	0.500	11	4	14.21	72.49	141.64
4.0	0.625	0.625	14	4	15.19	37.40	81.16	4.0	0.875	0.500	12	4	13.73	67.63	132.32
4.0	0.625	0.625	15	4	15.01	34.71	75.94	4.0	0.875	0.500	13	4	13.30	63.72	124.80
4.0	0.625	0.750	11	4	14.09	27.76	65.11	4.0	0.875	0.500	14	4	12.93	59.94	117.56
4.0	0.625	0.750	12	4	14.02	25.52	61.13	4.0	0.875	0.500	15	4	12.59	56.84	111.60
4.0	0.625	0.750	13	4	13.82	23.17	56.40	4.0	0.875	0.625	11	4	11.03	43.37	86.41
4.0	0.625	0.750	14	4	14.12	21.54	53.49	4.0	0.875	0.625	12	4	10.70	40.07	80.14
4.0	0.625	0.750	15	4	13.98	19.85	50.09	4.0	0.875	0.625	13	4	10.42	37.30	74.82
4.0	0.750	0.375	19	4	18.22	101.26	197.59	4.0	0.875	0.625	14	4	10.17	34.82	70.12
4.0	0.750	0.375	20	4	17.88	97.18	189.72	4.0	1.000	0.375	16	4	14.88	81.02	157.19
4.0	0.750	0.375	19	5	18.06	100.80	196.70	4.0	1.000	0.375	17	4	14.58	78.69	152.71
4.0	0.750	0.375	20	5	17.72	96.79	188.97	4.0	1.000	0.375	18	4	14.30	76.16	147.83
4.0	0.750	0.500	11	4	16.23	81.40	160.17	4.0	1.000	0.375	19	4	14.04	74.08	143.82
4.0	0.750	0.500	12	4	15.71	75.40	148.68	4.0	1.000	0.375	20	4	13.79	71.85	139.51
4.0	0.750	0.500	13	4	15.27	70.42	139.11	4.0	1.000	0.375	16	5	14.82	80.87	156.90
4.0	0.750	0.500	14	4	14.88	65.88	130.42	4.0	1.000	0.375	17	5	14.52	78.52	152.37
4.0	0.750	0.500	15	4	14.54	62.06	123.08	4.0	1.000	0.375	18	5	14.24	76.01	147.54
4.0	0.750	0.625	11	4	12.86	46.08	93.65	4.0	1.000	0.375	19	5	13.98	73.92	143.50
4.0	0.750	0.625	12	4	12.54	42.42	86.73	4.0	1.000	0.375	20	5	13.73	71.70	139.24
4.0	0.750	0.625	13	4	12.27	39.20	80.51	4.0	1.000	0.500	11	4	12.65	63.09	122.78
4.0	0.750	0.625	14	4	12.04	36.49	75.40	4.0	1.000	0.500	12	4	12.23	59.34	115.57
4.0	0.750	0.625	15	4	11.83	34.10	70.79	4.0	1.000	0.500	13	4	11.86	56.37	109.88
4.0	0.750	0.750	11	4	10.99	27.68	59.88	4.0	1.000	0.500	14	4	11.52	53.37	104.13
4.0	0.750	0.750	12	4	10.80	25.43	55.73	4.0	1.000	0.500	15	4	11.21	50.94	99.46

PLATE AREA - 900.0000

MAXIMUM STRESSES								MAXIMUM STRESSES							
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.750	6	6	41.52	77.90	182.36	1.2	0.500	0.750	7	7	47.18	72.16	179.28
1.0	0.500	0.750	7	6	41.66	77.35	181.09	1.2	0.500	0.750	8	7	47.03	61.74	158.53
1.0	0.500	0.750	6	7	41.46	77.35	181.09	1.2	0.625	0.750	7	6	31.87	72.62	160.47
1.0	0.500	0.750	7	7	41.49	66.24	161.66	1.2	0.625	0.750	8	6	31.66	62.28	140.27
1.0	0.625	0.625	8	8	29.24	96.21	197.58	1.2	0.625	0.750	7	7	31.64	72.43	159.93
1.0	0.625	0.750	6	6	28.29	76.54	163.84	1.2	0.625	0.750	8	7	31.44	62.03	139.64
1.0	0.625	0.750	7	6	28.24	75.86	162.33	1.2	0.750	0.750	7	6	23.71	71.40	149.29
1.0	0.625	0.750	6	7	28.02	75.86	162.33	1.2	0.750	0.750	8	6	23.45	61.35	129.83
1.0	0.625	0.750	7	7	27.94	66.29	145.03	1.2	0.750	0.750	7	7	23.43	70.89	148.16
1.0	0.750	0.625	8	8	22.23	91.90	184.16	1.2	0.750	0.750	8	7	23.18	60.91	128.84
1.0	0.750	0.750	6	6	21.31	73.73	151.41	1.2	0.875	0.625	8	6	20.99	97.23	192.69
1.0	0.750	0.750	7	6	21.15	72.82	149.47	1.2	0.875	0.625	8	7	20.56	93.79	189.82
1.0	0.750	0.750	6	7	20.94	72.82	149.47	1.2	0.875	0.750	7	6	18.90	68.91	140.01
1.0	0.750	0.750	7	7	20.79	64.79	134.71	1.2	0.875	0.750	8	6	18.61	59.52	121.90
1.0	0.875	0.625	7	7	18.82	100.59	198.43	1.2	0.875	0.750	7	7	18.59	68.15	138.43
1.0	0.875	0.625	8	7	18.55	98.83	194.93	1.2	0.875	0.750	8	7	18.31	58.89	120.58
1.0	0.875	0.625	7	8	18.35	98.83	194.93	1.2	1.000	0.625	8	6	17.89	90.67	178.30
1.0	0.875	0.625	8	8	18.09	86.53	171.21	1.2	1.000	0.625	7	7	17.91	100.85	197.82
1.0	0.875	0.750	6	6	17.19	70.09	140.84	1.2	1.000	0.625	8	7	17.48	89.06	175.11
1.0	0.875	0.750	7	6	16.98	68.90	138.40	1.2	1.000	0.750	7	6	15.82	65.56	131.06
1.0	0.875	0.750	6	7	16.77	68.90	138.40	1.2	1.000	0.750	8	6	15.52	57.05	114.67
1.0	0.875	0.750	7	7	16.57	62.28	126.13	1.2	1.000	0.750	7	7	15.50	64.61	129.13
1.0	1.000	0.625	6	6	17.03	102.02	199.55	1.2	1.000	0.750	8	7	15.21	56.26	113.07
1.0	1.000	0.625	7	6	16.67	99.23	194.09	1.4	0.500	0.750	7	5	48.89	74.12	186.19
1.0	1.000	0.625	8	6	16.37	96.99	189.67	1.4	0.500	0.750	8	5	48.66	63.97	166.14
1.0	1.000	0.625	6	7	16.45	99.23	194.09	1.4	0.500	0.750	9	5	48.49	75.08	163.54
1.0	1.000	0.625	7	7	16.12	92.87	182.06	1.4	0.500	0.750	7	6	48.49	73.93	185.68
1.0	1.000	0.625	8	8	15.84	90.90	178.19	1.4	0.500	0.750	8	6	48.28	63.82	165.67
1.0	1.000	0.625	6	8	15.98	96.99	189.67	1.4	0.500	0.750	9	6	48.11	55.14	149.68
1.0	1.000	0.625	7	8	15.67	90.90	178.19	1.4	0.625	0.750	7	5	33.07	75.15	166.84
1.0	1.000	0.625	8	8	15.41	80.51	158.16	1.4	0.625	0.750	8	5	32.77	71.92	148.11
1.0	1.000	0.750	6	6	14.53	65.93	130.85	1.4	0.625	0.750	9	5	32.54	71.44	147.06
1.0	1.000	0.750	7	6	14.29	64.50	127.98	1.4	0.625	0.750	7	6	32.68	74.73	165.88
1.0	1.000	0.750	6	7	14.10	64.50	127.98	1.4	0.625	0.750	8	6	32.39	64.35	145.68
1.0	1.000	0.750	7	7	13.88	59.14	117.98	1.4	0.625	0.750	9	6	32.16	56.45	130.94
1.2	0.500	0.750	7	6	47.32	71.91	179.01	1.4	0.750	0.625	9	6	25.88	95.33	192.93
1.2	0.500	0.750	8	6	47.18	61.78	158.79	1.4	0.750	0.750	7	5	24.71	74.17	155.47

PLATE AREA - 900.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.4	0.750	0.750	8	5	24.35	63.81	135.45	1.6	0.625	0.750	8	6	31.47	64.24	145.76
1.4	0.750	0.750	7	5	24.08	64.55	133.51	1.6	0.625	0.750	9	6	31.19	55.95	130.11
1.4	0.750	0.750	9	6	24.33	73.53	154.11	1.6	0.750	0.625	9	5	25.65	95.18	192.75
1.4	0.750	0.750	8	6	23.98	63.35	134.44	1.6	0.750	0.625	10	5	25.22	90.09	176.61
1.4	0.750	0.750	9	6	23.71	56.29	121.18	1.6	0.750	0.625	9	6	25.29	94.44	191.24
1.4	0.875	0.625	9	5	21.47	94.07	183.82	1.6	0.750	0.625	10	6	24.86	84.70	172.48
1.4	0.875	0.625	8	6	21.50	99.87	198.04	1.6	0.750	0.750	7	5	24.11	73.62	154.44
1.4	0.875	0.625	9	6	21.03	91.04	181.20	1.6	0.750	0.750	8	5	23.67	63.56	135.06
1.4	0.875	0.750	7	5	19.79	71.79	146.06	1.6	0.750	0.750	9	5	23.34	56.16	121.04
1.4	0.875	0.750	8	5	19.39	61.99	127.19	1.6	0.750	0.750	7	6	23.82	73.11	153.38
1.4	0.875	0.750	9	5	19.08	61.21	121.16	1.6	0.750	0.750	8	6	23.39	63.24	134.36
1.4	0.875	0.750	7	6	19.42	70.97	144.37	1.6	0.750	0.750	9	6	23.06	55.81	120.31
1.4	0.875	0.750	8	6	19.04	61.38	125.91	1.6	0.875	0.625	8	5	21.54	100.36	199.06
1.4	0.875	0.750	9	6	18.73	55.16	114.18	1.6	0.875	0.625	9	5	20.97	91.01	181.19
1.4	1.000	0.625	8	5	18.77	94.32	185.54	1.6	0.875	0.625	10	5	20.51	81.89	163.63
1.4	1.000	0.625	9	5	18.28	84.90	171.36	1.6	0.875	0.625	8	6	21.20	99.40	197.15
1.4	1.000	0.625	8	6	18.36	92.84	182.60	1.6	0.875	0.625	9	6	20.64	90.12	179.42
1.4	1.000	0.625	9	6	17.89	85.58	168.74	1.6	0.875	0.625	10	6	20.19	81.17	162.19
1.4	1.000	0.750	7	5	16.63	68.43	136.87	1.6	0.875	0.750	7	5	19.38	71.25	145.00
1.4	1.000	0.750	8	5	16.21	59.46	119.63	1.6	0.875	0.750	8	5	18.91	61.67	126.58
1.4	1.000	0.750	9	5	15.88	55.88	109.77	1.6	0.875	0.750	9	5	18.54	55.13	114.18
1.4	1.000	0.750	7	6	16.29	67.46	134.93	1.6	0.875	0.750	7	6	19.11	70.62	143.72
1.4	1.000	0.750	8	6	15.88	58.72	118.12	1.6	0.875	0.750	8	6	18.65	61.25	125.70
1.4	1.000	0.750	9	6	15.56	53.31	107.90	1.6	0.875	0.750	9	6	18.28	54.70	113.29
1.6	0.500	0.625	10	6	47.84	87.32	199.79	1.6	1.000	0.625	8	5	18.90	93.26	183.44
1.6	0.500	0.750	7	5	47.38	73.53	185.37	1.6	1.000	0.625	9	5	17.94	85.55	168.70
1.6	0.500	0.750	8	5	47.09	63.80	166.41	1.6	1.000	0.625	10	5	17.46	77.43	153.07
1.6	0.500	0.750	9	5	46.87	54.74	149.34	1.6	1.000	0.625	8	6	18.19	92.19	181.33
1.6	0.500	0.750	7	6	47.06	73.32	184.87	1.6	1.000	0.625	9	6	17.64	84.59	166.79
1.6	0.500	0.750	8	6	46.78	63.68	166.08	1.6	1.000	0.625	10	6	17.18	76.63	151.48
1.6	0.500	0.750	9	6	46.56	54.62	149.00	1.6	1.000	0.750	7	5	16.37	67.85	135.72
1.6	0.625	0.625	10	5	33.19	100.61	199.04	1.6	1.000	0.750	8	5	15.87	59.05	118.82
1.6	0.625	0.625	10	6	32.80	86.90	183.56	1.6	1.000	0.750	9	5	15.48	53.34	107.98
1.6	0.625	0.750	7	5	32.14	74.57	165.85	1.6	1.000	0.750	7	6	16.11	67.13	134.28
1.6	0.625	0.750	8	5	31.77	64.45	146.27	1.6	1.000	0.750	8	6	15.63	58.53	117.76
1.6	0.625	0.750	9	5	31.49	56.18	130.65	1.6	1.000	0.750	9	6	15.25	52.84	106.97
1.6	0.625	0.750	7	5	31.84	74.20	165.05	1.8	0.500	0.625	10	5	45.47	98.26	197.14

PLATE AREA - 900.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.8	0.500	0.625	10	6	45.12	85.15	195.09	1.8	0.875	0.750	10	6	17.13	47.80	99.80
1.8	0.500	0.750	8	5	44.32	62.43	163.03	1.8	1.000	0.625	8	5	17.93	90.65	178.28
1.8	0.500	0.750	9	5	44.07	53.19	145.22	1.8	1.000	0.625	9	5	17.31	82.85	163.35
1.8	0.500	0.750	10	5	43.87	47.70	134.76	1.8	1.000	0.625	10	5	16.80	75.06	148.33
1.8	0.500	0.750	8	6	44.07	62.34	162.78	1.8	1.000	0.625	8	6	17.69	89.89	176.78
1.8	0.500	0.750	9	6	43.81	53.05	144.88	1.8	1.000	0.625	9	6	17.08	82.13	161.92
1.8	0.500	0.750	10	6	43.62	47.62	134.54	1.8	1.000	0.625	10	6	16.58	74.49	147.22
1.8	0.625	0.625	9	5	31.82	94.81	198.53	1.8	1.000	0.750	8	5	15.25	57.62	115.90
1.8	0.625	0.625	10	5	31.40	85.03	179.72	1.8	1.000	0.750	9	5	14.82	51.80	104.82
1.8	0.625	0.625	9	6	31.51	94.37	197.62	1.8	1.000	0.750	10	5	14.47	46.58	94.81
1.8	0.625	0.625	10	6	31.09	84.73	179.07	1.8	1.000	0.750	8	6	15.06	57.25	115.16
1.8	0.625	0.750	8	5	30.02	63.05	143.15	1.8	1.000	0.750	9	6	14.64	51.42	104.05
1.8	0.625	0.750	9	5	29.70	54.60	127.00	1.8	1.000	0.750	10	6	14.29	46.30	94.23
1.8	0.625	0.750	10	5	29.45	48.93	116.15								
1.8	0.625	0.750	8	6	29.78	62.90	142.80	2.0	0.500	0.625	10	5	42.32	82.36	188.74
1.8	0.625	0.750	9	6	29.46	54.38	126.53	2.0	0.500	0.625	11	5	42.02	88.62	176.79
1.8	0.625	0.750	10	6	29.21	48.79	115.83	2.0	0.500	0.750	8	5	41.16	60.50	157.82
1.8	0.750	0.625	9	5	24.46	92.41	187.15	2.0	0.500	0.750	9	5	40.88	51.18	139.48
1.8	0.750	0.625	10	5	23.98	82.97	168.97	2.0	0.500	0.750	10	5	40.82	46.09	130.02
1.8	0.750	0.625	9	6	24.18	91.84	185.99	2.0	0.500	0.750	11	5	40.60	40.40	118.74
1.8	0.750	0.625	10	6	23.71	82.55	168.12	2.0	0.625	0.625	9	5	29.84	91.22	190.97
1.8	0.750	0.750	8	5	22.48	62.15	132.07	2.0	0.625	0.625	10	5	29.39	82.05	173.39
1.8	0.750	0.750	9	5	22.11	54.58	117.63	2.0	0.625	0.625	11	5	29.02	73.49	156.90
1.8	0.750	0.750	10	5	21.81	48.88	106.71	2.0	0.625	0.750	8	5	28.02	61.07	138.57
1.8	0.750	0.750	8	6	22.26	61.93	131.59	2.0	0.625	0.750	9	5	27.68	52.55	122.10
1.8	0.750	0.750	9	6	21.89	54.29	117.03	2.0	0.625	0.750	10	5	27.40	47.26	112.08
1.8	0.750	0.750	10	6	21.59	48.69	106.30	2.0	0.625	0.750	11	5	27.19	41.92	101.73
1.8	0.875	0.625	8	5	20.74	97.79	193.93	2.0	0.750	0.625	9	5	23.10	88.89	179.96
1.8	0.875	0.625	9	5	20.12	88.28	175.73	2.0	0.750	0.625	10	5	22.59	79.98	162.86
1.8	0.875	0.625	10	5	19.61	79.54	158.92	2.0	0.750	0.625	11	5	22.18	72.38	148.26
1.8	0.875	0.625	8	6	20.48	97.12	192.59	2.0	0.750	0.750	8	5	21.12	60.18	127.78
1.8	0.875	0.625	9	6	19.87	87.61	174.40	2.0	0.750	0.750	9	5	20.71	52.54	113.13
1.8	0.875	0.625	10	6	19.37	79.03	157.89	2.0	0.750	0.750	10	5	20.40	47.19	102.94
1.8	0.875	0.750	8	5	18.06	60.26	123.65	2.0	0.750	0.750	11	5	20.14	42.27	93.49
1.8	0.875	0.750	9	5	17.65	53.57	110.91	2.0	0.875	0.625	8	5	19.80	94.35	187.07
1.8	0.875	0.750	10	5	17.32	48.03	100.30	2.0	0.875	0.625	9	5	19.14	84.83	168.81
1.8	0.875	0.750	8	6	17.85	59.96	123.04	2.0	0.875	0.625	10	5	18.60	76.57	152.94
1.8	0.875	0.750	9	6	17.45	53.23	110.22	2.0	0.875	0.625	11	5	18.16	69.95	140.24

PLATE AREA - 900.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
2.0	0.875	0.750	8	5	17.08	58.29	119.55	4.0	0.625	0.750	12	4	14.76	27.81	66.12
2.0	0.875	0.750	9	5	16.64	51.56	106.68	4.0	0.625	0.750	13	4	14.61	25.25	60.96
2.0	0.875	0.750	10	5	16.29	46.34	96.70	4.0	0.625	0.750	14	4	14.85	23.48	57.80
2.0	0.875	0.750	11	5	16.01	41.87	88.14	4.0	0.625	0.750	15	4	14.70	21.64	54.10
2.0	1.000	0.625	8	5	17.21	87.26	171.55	4.0	0.750	0.500	11	4	17.18	88.68	174.38
2.0	1.000	0.625	9	5	16.56	79.48	156.64	4.0	0.750	0.500	12	4	16.64	82.14	161.85
2.0	1.000	0.625	10	5	16.03	72.12	142.49	4.0	0.750	0.500	13	4	16.17	76.72	151.42
2.0	1.000	0.625	11	5	15.98	66.48	131.67	4.0	0.750	0.500	14	4	15.76	71.77	141.94
2.0	1.000	0.750	8	5	14.51	55.66	111.90	4.0	0.750	0.500	15	4	15.39	67.61	133.95
2.0	1.000	0.750	9	5	14.06	49.83	100.76	4.0	0.750	0.625	11	4	13.62	50.20	101.81
2.0	1.000	0.750	10	5	13.69	44.89	91.31	4.0	0.750	0.625	12	4	13.29	46.21	94.26
2.0	1.000	0.750	11	5	13.38	40.89	83.66	4.0	0.750	0.625	13	4	13.00	42.70	87.49
4.0	0.500	0.500	12	4	26.03	93.50	193.16	4.0	0.750	0.625	14	4	12.75	39.75	81.91
4.0	0.500	0.500	13	4	25.63	85.64	177.86	4.0	0.750	0.750	15	4	12.54	37.14	76.89
4.0	0.500	0.500	14	4	25.29	79.72	166.65	4.0	0.750	0.750	11	4	11.65	30.14	64.95
4.0	0.500	0.500	15	4	25.00	73.99	155.52	4.0	0.750	0.750	12	4	11.44	27.70	60.43
4.0	0.500	0.625	11	4	23.01	52.20	118.82	4.0	0.750	0.750	13	4	11.27	25.37	55.90
4.0	0.500	0.625	12	4	22.76	48.10	111.43	4.0	0.750	0.750	14	4	11.11	23.59	52.59
4.0	0.500	0.625	13	4	22.56	43.57	102.32	4.0	0.750	0.750	15	4	10.98	21.89	49.30
4.0	0.500	0.625	14	4	22.38	51.32	99.67	4.0	0.875	0.375	17	4	17.56	102.52	199.24
4.0	0.500	0.625	15	4	22.23	50.91	98.87	4.0	0.875	0.375	18	4	17.19	98.63	191.74
4.0	0.500	0.750	11	4	22.69	29.36	80.32	4.0	0.875	0.375	19	4	16.84	95.39	185.50
4.0	0.500	0.750	12	4	23.45	27.05	76.64	4.0	0.875	0.375	20	4	16.52	92.03	179.02
4.0	0.500	0.750	13	4	22.82	24.26	70.57	4.0	0.875	0.375	17	5	17.45	102.20	198.63
4.0	0.500	0.750	14	4	23.36	22.58	67.86	4.0	0.875	0.375	18	5	17.08	98.36	191.24
4.0	0.500	0.750	15	4	22.90	33.41	65.19	4.0	0.875	0.375	19	5	16.74	95.09	184.93
4.0	0.625	0.500	11	4	20.46	96.67	192.63	4.0	0.875	0.500	20	5	16.42	91.78	178.54
4.0	0.625	0.500	12	4	19.93	89.09	178.14	4.0	0.875	0.500	11	4	15.04	78.98	154.25
4.0	0.625	0.500	13	4	19.47	82.46	165.36	4.0	0.875	0.500	12	4	14.93	73.68	144.10
4.0	0.625	0.500	14	4	19.08	76.85	154.62	4.0	0.875	0.500	13	4	14.09	69.41	135.90
4.0	0.625	0.500	15	4	18.73	71.90	145.10	4.0	0.875	0.500	14	4	13.69	65.30	128.01
4.0	0.625	0.625	11	4	16.87	52.01	109.40	4.0	0.875	0.625	15	4	13.34	61.92	121.52
4.0	0.625	0.625	12	4	16.57	47.83	101.57	4.0	0.875	0.625	11	4	11.69	47.24	94.01
4.0	0.625	0.625	13	4	16.31	43.81	93.74	4.0	0.875	0.625	12	4	11.34	43.65	87.18
4.0	0.625	0.625	14	4	16.09	40.75	88.02	4.0	0.875	0.625	13	4	11.03	40.62	81.38
4.0	0.625	0.625	15	4	15.91	37.83	82.32	4.0	0.875	0.625	14	4	10.77	37.93	76.25
4.0	0.625	0.750	11	4	14.94	30.25	70.46	4.0	1.000	0.375	15	4	10.54	35.64	71.86
4.0	0.625	0.750	11	4	14.94	30.25	70.46	4.0	1.000	0.375	12	4	17.26	101.10	195.99

PLATE AREA - 900.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
4.0	1.000	0.375	13	4	16.85	97.94	189.90
4.0	1.000	0.375	14	4	16.46	94.27	182.82
4.0	1.000	0.375	15	4	16.10	91.44	177.37
4.0	1.000	0.375	16	4	15.76	88.27	171.27
4.0	1.000	0.375	17	4	15.44	85.74	166.39
4.0	1.000	0.375	18	4	15.14	82.98	161.06
4.0	1.000	0.375	19	4	14.86	80.72	156.69
4.0	1.000	0.375	20	4	14.60	78.28	152.00
4.0	1.000	0.375	12	5	17.19	100.94	193.68
4.0	1.000	0.375	13	5	16.78	97.72	189.47
4.0	1.000	0.375	14	5	16.39	94.10	182.50
4.0	1.000	0.375	15	5	16.03	91.23	176.97
4.0	1.000	0.375	16	5	15.69	88.11	170.95
4.0	1.000	0.375	17	5	15.38	85.55	166.02
4.0	1.000	0.375	18	5	15.08	82.82	160.76
4.0	1.000	0.375	19	5	14.80	80.54	156.35
4.0	1.000	0.375	20	5	14.54	78.13	151.70
4.0	1.000	0.500	11	4	13.39	68.74	133.74
4.0	1.000	0.500	12	4	12.95	64.64	125.89
4.0	1.000	0.500	13	4	12.55	61.41	119.68
4.0	1.000	0.500	14	4	12.20	58.15	113.41
4.0	1.000	0.500	15	4	11.87	55.50	108.33
4.0	1.000	0.625	11	4	10.38	43.54	85.72
4.0	1.000	0.625	12	4	10.04	40.44	79.81

PLATE AREA - 950.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.750	6	6	43.78	84.71	196.53	1.0	1.000	0.625	7	7	17.02	100.82	197.53
1.0	0.500	0.750	7	6	43.95	84.10	195.14	1.0	1.000	0.625	8	7	16.73	98.68	193.33
1.0	0.500	0.750	8	6	43.88	83.82	194.43	1.0	1.000	0.625	7	8	16.54	98.68	193.33
1.0	0.500	0.750	6	7	43.74	84.10	195.14	1.0	1.000	0.625	8	8	16.26	87.40	171.58
1.0	0.500	0.750	7	7	43.77	72.03	173.93	1.0	1.000	0.750	6	6	15.33	71.59	141.90
1.0	0.500	0.750	8	7	43.69	71.90	173.51	1.0	1.000	0.750	7	6	15.08	70.04	138.80
1.0	0.500	0.750	6	8	43.52	83.82	194.43	1.0	1.000	0.750	8	6	14.88	68.83	136.38
1.0	0.500	0.750	7	8	43.54	71.90	173.51	1.0	1.000	0.750	6	7	14.88	70.04	138.80
1.0	0.500	0.750	8	8	43.45	61.16	152.12	1.0	1.000	0.750	7	7	14.65	64.22	127.93
1.0	0.625	0.750	6	6	29.84	83.17	177.17	1.0	1.000	0.750	8	7	14.46	63.17	125.83
1.0	0.625	0.750	7	6	29.79	82.42	175.52	1.0	1.000	0.750	6	8	14.52	68.83	136.38
1.0	0.625	0.750	8	6	29.66	81.95	174.47	1.0	1.000	0.750	7	8	14.30	63.17	125.83
1.0	0.625	0.750	6	7	29.57	82.42	175.52	1.0	1.000	0.750	8	8	14.12	55.10	110.29
1.0	0.625	0.750	7	7	29.49	72.03	156.67	1.2	0.500	0.750	7	6	49.92	78.15	192.37
1.0	0.625	0.750	8	7	29.36	71.66	155.80	1.2	0.500	0.750	8	6	49.77	67.19	170.51
1.0	0.625	0.750	6	8	29.28	81.95	174.47	1.2	0.500	0.750	7	7	49.77	78.46	192.73
1.0	0.625	0.750	7	8	29.20	71.66	155.80	1.2	0.500	0.750	8	7	49.61	67.15	170.25
1.0	0.625	0.750	8	8	29.07	61.16	135.29	1.2	0.625	0.750	7	6	33.63	78.87	173.21
1.0	0.750	0.625	6	6	23.47	99.79	199.63	1.2	0.625	0.750	8	6	33.41	67.66	151.32
1.0	0.750	0.750	6	6	22.49	80.09	163.98	1.2	0.625	0.750	7	7	33.39	78.67	172.65
1.0	0.750	0.750	7	6	22.32	79.09	161.89	1.2	0.625	0.750	8	7	33.17	67.40	150.65
1.0	0.750	0.750	8	6	22.15	78.38	160.39	1.2	0.750	0.750	7	6	25.02	77.52	161.50
1.0	0.750	0.750	6	7	22.10	79.09	161.89	1.2	0.750	0.750	8	6	24.75	66.62	140.40
1.0	0.750	0.750	7	7	21.94	70.37	145.82	1.2	0.750	0.750	7	7	24.72	76.97	160.30
1.0	0.750	0.750	8	7	21.78	69.75	144.51	1.2	0.750	0.750	8	7	24.46	66.14	139.33
1.0	0.750	0.750	6	8	21.76	78.38	160.39	1.2	0.875	0.750	7	6	19.95	74.81	151.65
1.0	0.750	0.750	7	8	21.61	69.75	144.51	1.2	0.875	0.750	8	6	19.64	64.62	131.99
1.0	0.750	0.750	8	8	21.46	59.84	125.32	1.2	0.875	0.750	7	7	19.62	73.98	149.94
1.0	0.875	0.625	6	6	19.10	93.94	185.69	1.2	0.875	0.750	8	7	19.33	63.94	130.57
1.0	0.875	0.750	6	6	18.14	76.11	152.66	1.2	0.875	0.750	7	8	18.89	98.41	193.38
1.0	0.875	0.750	7	6	17.91	74.82	150.03	1.2	1.000	0.625	8	6	18.45	96.66	189.93
1.0	0.875	0.750	8	6	17.72	73.85	148.04	1.2	1.000	0.625	7	7	18.45	71.17	142.05
1.0	0.875	0.750	6	7	17.70	74.82	150.03	1.2	1.000	0.750	8	6	16.70	61.93	124.26
1.0	0.875	0.750	7	7	17.49	67.64	136.68	1.2	1.000	0.750	8	7	16.36	70.14	139.97
1.0	0.875	0.750	8	7	17.31	66.79	134.95	1.2	1.000	0.750	7	8	16.36	61.08	122.53
1.0	0.875	0.750	6	8	17.34	73.85	148.04	1.2	1.000	0.750	8	7	16.06	80.53	200.00
1.0	0.875	0.750	7	8	17.15	66.79	134.95	1.4	0.500	0.750	7	5	51.58		
1.0	0.875	0.750	8	8	16.98	57.73	117.48								

PLATE AREA - 750.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.4	0.500	0.750	8	5	51.34	69.57	178.34	1.6	0.500	0.750	10	5	49.27	71.19	151.74
1.4	0.500	0.750	9	5	51.16	81.67	176.89	1.6	0.500	0.750	8	6	49.36	69.25	178.28
1.4	0.500	0.750	7	6	51.16	80.35	199.49	1.6	0.500	0.750	9	6	49.13	59.40	159.70
1.4	0.500	0.750	8	6	50.93	69.40	177.85	1.6	0.500	0.750	10	6	48.95	53.11	147.48
1.4	0.500	0.750	9	6	50.75	59.97	160.43	1.6	0.625	0.625	10	6	34.61	94.34	198.46
1.4	0.625	0.750	7	5	34.90	81.59	180.01	1.6	0.625	0.750	8	5	33.53	69.99	157.72
1.4	0.625	0.750	8	5	34.58	78.20	160.56	1.6	0.625	0.750	9	5	33.23	61.01	140.74
1.4	0.625	0.750	9	5	34.33	77.68	159.43	1.6	0.625	0.750	10	5	32.99	67.28	136.90
1.4	0.625	0.750	7	6	34.48	81.14	179.00	1.6	0.625	0.750	8	6	33.21	69.77	157.19
1.4	0.625	0.750	8	6	34.17	69.90	157.12	1.6	0.625	0.750	9	6	32.91	60.77	140.17
1.4	0.625	0.750	9	6	33.93	61.32	141.08	1.6	0.625	0.750	10	6	32.68	54.33	127.74
1.4	0.750	0.750	7	5	26.08	80.51	168.13	1.6	0.750	0.625	10	5	26.62	97.89	191.80
1.4	0.750	0.750	8	5	25.70	73.16	146.56	1.6	0.750	0.625	10	6	26.25	91.93	186.75
1.4	0.750	0.750	9	5	25.41	72.35	144.89	1.6	0.750	0.750	8	5	24.98	69.00	145.99
1.4	0.750	0.750	7	6	25.68	79.81	166.67	1.6	0.750	0.750	9	5	24.63	60.96	130.79
1.4	0.750	0.750	8	6	25.31	68.78	145.35	1.6	0.750	0.750	10	5	24.35	62.25	124.03
1.4	0.750	0.750	9	6	25.02	61.12	130.92	1.6	0.750	0.750	8	6	24.68	68.66	145.25
1.4	0.875	0.625	9	6	22.20	98.80	196.40	1.6	0.750	0.750	9	6	24.34	60.59	129.97
1.4	0.875	0.625	9	7	21.88	97.81	194.41	1.6	0.750	0.750	10	6	24.06	54.19	117.63
1.4	0.875	0.750	7	5	20.88	77.92	158.15	1.6	0.875	0.625	9	5	22.14	98.76	196.37
1.4	0.875	0.750	8	5	20.46	67.29	137.69	1.6	0.875	0.625	10	5	21.65	88.86	177.31
1.4	0.875	0.750	9	5	20.13	66.52	131.54	1.6	0.875	0.625	9	6	21.79	97.80	194.45
1.4	0.875	0.750	7	6	20.50	77.02	156.34	1.6	0.875	0.625	10	6	21.32	88.09	175.75
1.4	0.875	0.750	8	6	20.09	66.63	136.31	1.6	0.875	0.750	8	5	19.96	66.94	137.02
1.4	0.875	0.750	9	6	19.77	59.88	123.55	1.6	0.875	0.750	9	5	19.57	59.83	123.53
1.4	1.000	0.625	8	6	19.38	100.75	198.02	1.6	0.875	0.750	10	5	19.25	56.89	112.13
1.4	1.000	0.625	9	6	18.88	92.87	182.97	1.6	0.875	0.750	8	6	19.68	66.48	136.06
1.4	1.000	0.625	8	7	19.06	99.45	195.47	1.6	0.875	0.750	9	6	19.30	59.37	122.57
1.4	1.000	0.625	9	7	18.57	91.73	180.72	1.6	0.875	0.750	10	6	18.99	53.19	110.69
1.4	1.000	0.750	7	5	17.55	74.26	148.32	1.6	1.000	0.625	8	5	19.53	101.19	198.91
1.4	1.000	0.750	8	5	17.11	64.53	129.61	1.6	1.000	0.625	9	5	18.93	92.83	182.91
1.4	1.000	0.750	9	5	16.76	60.72	119.20	1.6	1.000	0.625	10	5	18.44	84.02	165.94
1.4	1.000	0.750	7	6	17.19	73.21	146.22	1.6	1.000	0.625	8	6	18.21	100.04	196.62
1.4	1.000	0.750	8	6	16.76	63.73	127.98	1.6	1.000	0.625	9	6	18.62	91.79	180.84
1.4	1.000	0.750	9	6	16.42	57.87	116.87	1.6	1.000	0.625	10	6	18.14	83.16	164.22
1.6	0.500	0.750	8	5	49.69	69.37	178.63	1.6	1.000	0.750	8	5	16.75	64.08	128.72
1.6	0.500	0.750	9	5	49.45	59.52	160.04	1.6	1.000	0.750	9	5	16.34	57.89	116.94
											10	5	16.01	51.98	105.59

PLATE AREA - 950.0000

MAXIMUM STRESSES								MAXIMUM STRESSES							
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	1.000	0.750	8	6	16.50	63.51	127.57	1.8	1.000	0.625	8	6	18.67	97.53	191.67
1.6	1.000	0.750	9	6	16.09	57.35	115.85	1.8	1.000	0.625	9	6	18.03	89.11	175.54
1.6	1.000	0.750	10	6	15.77	51.55	104.71	1.8	1.000	0.625	10	6	17.51	80.82	159.59
1.8	0.500	0.750	8	5	46.78	67.88	175.01	1.8	1.000	0.750	8	5	16.10	62.52	125.54
1.8	0.500	0.750	9	5	46.51	57.83	155.65	1.8	1.000	0.750	9	5	15.64	56.20	113.51
1.8	0.500	0.750	10	5	46.30	51.89	144.33	1.8	1.000	0.750	10	5	15.27	50.54	102.65
1.8	0.500	0.750	8	6	46.50	67.78	174.75	1.8	1.000	0.750	8	6	15.90	62.12	124.74
1.8	0.500	0.750	9	6	46.24	57.69	155.31	1.8	1.000	0.750	9	6	15.45	55.79	112.68
1.8	0.500	0.750	10	6	46.03	51.80	144.10	1.8	1.000	0.750	10	6	15.09	50.24	102.03
1.8	0.625	0.625	10	5	33.14	92.30	194.29	2.0	0.500	0.625	11	5	44.35	96.39	192.01
1.8	0.625	0.625	10	6	32.81	91.98	193.60	2.0	0.500	0.750	8	5	43.44	65.76	169.45
1.8	0.625	0.750	8	5	31.69	68.47	154.37	2.0	0.500	0.750	9	5	43.15	55.64	149.55
1.8	0.625	0.750	9	5	31.35	59.29	136.81	2.0	0.500	0.750	10	5	42.92	50.13	139.29
1.8	0.625	0.750	10	5	31.08	53.15	125.05	2.0	0.500	0.750	11	5	42.74	43.95	127.06
1.8	0.625	0.750	8	6	31.43	68.30	153.99	2.0	0.625	0.625	10	5	31.02	89.05	187.44
1.8	0.625	0.750	9	6	31.09	59.06	136.32	2.0	0.625	0.625	11	5	30.63	86.60	170.10
1.8	0.625	0.750	10	6	30.83	53.00	124.71	2.0	0.625	0.750	8	5	29.58	66.32	149.43
1.8	0.750	0.625	10	5	25.31	90.04	182.94	2.0	0.625	0.750	9	5	29.22	57.06	131.54
1.8	0.750	0.625	10	6	25.02	89.59	182.02	2.0	0.625	0.750	10	5	28.93	51.33	120.68
1.8	0.750	0.625	8	5	23.73	67.46	142.75	2.0	0.625	0.750	11	5	28.70	45.53	109.45
1.8	0.750	0.750	9	5	23.33	59.24	127.06	2.0	0.750	0.625	9	5	24.39	96.45	194.86
1.8	0.750	0.750	10	5	23.02	53.06	115.23	2.0	0.750	0.625	10	5	23.85	86.79	176.31
1.8	0.750	0.750	8	6	23.49	67.22	142.24	2.0	0.750	0.625	11	5	23.41	78.54	160.46
1.8	0.750	0.750	9	6	23.10	58.93	126.42	2.0	0.750	0.750	8	5	22.29	65.31	138.13
1.8	0.750	0.750	10	6	22.79	52.84	114.78	2.0	0.750	0.750	9	5	21.87	57.02	122.21
1.8	0.875	0.625	9	5	21.24	95.78	190.43	2.0	0.750	0.750	10	5	21.53	51.23	111.16
1.8	0.875	0.625	10	5	20.70	86.31	172.19	2.0	0.750	0.750	11	5	21.26	45.89	100.89
1.8	0.875	0.625	9	6	20.97	95.04	188.99	2.0	0.875	0.625	9	5	20.20	92.03	182.92
1.8	0.875	0.625	10	6	20.45	85.76	171.09	2.0	0.875	0.625	10	5	19.64	83.08	165.71
1.8	0.875	0.750	8	5	19.06	65.39	133.84	2.0	0.875	0.625	11	5	19.17	75.90	151.92
1.8	0.875	0.750	9	5	18.63	58.13	120.00	2.0	0.875	0.750	8	5	18.03	63.25	129.39
1.8	0.875	0.750	10	5	18.28	52.13	108.48	2.0	0.875	0.750	9	5	17.57	55.95	115.41
1.8	0.875	0.750	8	6	18.85	65.07	133.18	2.0	0.875	0.750	10	5	17.20	50.29	104.59
1.8	0.875	0.750	9	6	18.42	57.77	119.25	2.0	0.875	0.750	11	5	16.90	45.44	95.30
1.8	0.875	0.750	10	6	18.08	51.87	107.95	2.0	1.000	0.625	8	5	18.17	94.67	186.00
1.8	1.000	0.625	8	5	18.92	98.36	193.30	2.0	1.000	0.625	9	5	17.49	86.23	169.81
1.8	1.000	0.625	9	5	18.27	89.89	177.07	2.0	1.000	0.625	10	5	16.92	78.24	154.46
1.8	1.000	0.625	10	5	17.73	81.44	160.82	2.0	1.000	0.625	11	5	16.45	72.12	142.71

PLATE AREA - 950.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
2.0	1.000	0.750	8	5	15.32	60.39	121.21	4.0	0.750	0.500	16	4	15.91	69.12	137.06
2.0	1.000	0.750	9	5	14.84	54.06	109.11	4.0	0.750	0.625	11	4	14.39	54.43	110.18
2.0	1.000	0.750	10	5	14.45	48.71	98.86	4.0	0.750	0.625	12	4	14.03	50.11	102.00
2.0	1.000	0.750	11	5	14.13	44.36	90.56	4.0	0.750	0.625	13	4	13.73	46.30	94.65
4.0	0.500	0.500	13	4	27.07	92.89	192.32	4.0	0.750	0.625	14	4	13.47	43.11	88.60
4.0	0.500	0.500	14	4	26.71	86.47	180.16	4.0	0.750	0.625	15	4	13.24	40.28	83.15
4.0	0.500	0.500	15	4	26.40	86.88	168.43	4.0	0.750	0.750	11	4	12.31	32.68	70.15
4.0	0.500	0.500	16	4	26.13	85.86	166.45	4.0	0.750	0.750	12	4	12.09	30.03	65.25
4.0	0.500	0.625	11	4	24.31	56.63	128.08	4.0	0.750	0.750	13	4	11.90	27.51	60.34
4.0	0.500	0.625	12	4	24.05	52.19	120.06	4.0	0.750	0.750	14	4	11.74	25.57	56.75
4.0	0.500	0.625	13	4	23.83	47.27	110.19	4.0	0.750	0.750	15	4	11.61	23.74	53.18
4.0	0.500	0.625	14	4	23.65	55.84	108.44	4.0	0.875	0.375	20	4	17.44	99.81	194.13
4.0	0.500	0.625	15	4	23.49	55.40	107.58	4.0	0.875	0.375	21	4	17.12	96.73	188.19
4.0	0.500	0.750	11	4	23.77	31.87	86.21	4.0	0.875	0.375	20	5	17.33	99.54	193.60
4.0	0.500	0.750	12	4	24.57	29.38	82.21	4.0	0.875	0.500	12	4	15.34	79.90	156.21
4.0	0.500	0.750	13	4	23.92	26.35	75.65	4.0	0.875	0.500	13	4	14.87	75.27	147.31
4.0	0.500	0.750	14	4	24.48	24.53	72.70	4.0	0.875	0.500	14	4	14.45	70.82	138.75
4.0	0.500	0.750	15	4	24.00	36.42	71.04	4.0	0.875	0.500	15	4	14.08	67.15	131.71
4.0	0.625	0.500	12	4	21.04	96.61	192.92	4.0	0.875	0.500	16	4	13.75	63.59	124.87
4.0	0.625	0.500	13	4	20.56	89.43	179.06	4.0	0.875	0.625	11	4	12.34	51.22	101.83
4.0	0.625	0.500	14	4	20.14	83.34	167.41	4.0	0.875	0.625	12	4	11.97	47.32	94.41
4.0	0.625	0.500	15	4	19.78	77.98	157.08	4.0	0.875	0.625	13	4	11.65	44.05	88.12
4.0	0.625	0.500	16	4	19.47	73.29	148.09	4.0	0.875	0.625	14	4	11.37	41.13	82.56
4.0	0.625	0.625	11	4	17.82	56.40	118.24	4.0	0.875	0.750	15	4	10.26	31.81	65.60
4.0	0.625	0.625	12	4	17.50	51.87	109.75	4.0	0.875	0.750	12	4	10.02	29.26	60.82
4.0	0.625	0.625	13	4	17.23	47.51	101.26	4.0	1.000	0.375	14	4	17.38	102.24	198.28
4.0	0.625	0.625	14	4	17.00	44.20	95.05	4.0	1.000	0.375	15	4	16.99	99.17	192.36
4.0	0.625	0.625	15	4	16.80	41.03	88.87	4.0	1.000	0.375	16	4	16.64	95.74	185.74
4.0	0.625	0.750	11	4	15.78	32.80	75.92	4.0	1.000	0.375	17	4	16.30	92.99	180.45
4.0	0.625	0.750	12	4	15.59	30.17	71.21	4.0	1.000	0.375	18	4	15.99	90.00	174.67
4.0	0.625	0.750	13	4	15.44	27.39	65.63	4.0	1.000	0.375	19	4	15.69	87.54	169.93
4.0	0.625	0.750	14	4	15.55	25.47	62.19	4.0	1.000	0.375	20	4	15.41	84.90	164.84
4.0	0.625	0.750	15	4	15.40	30.02	58.28	4.0	1.000	0.375	21	4	15.14	82.69	160.58
4.0	0.750	0.500	12	4	17.57	89.07	175.39	4.0	1.000	0.375	14	5	17.30	102.06	197.93
4.0	0.750	0.500	13	4	17.07	83.20	164.08	4.0	1.000	0.375	15	5	16.92	98.95	191.94
4.0	0.750	0.500	14	4	16.64	77.83	153.79	4.0	1.000	0.375	16	5	16.56	95.56	185.40
4.0	0.750	0.500	15	4	16.25	73.32	149.12								

PLATE AREA - 950.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
4.0	1.000	0.375	17	5	16.23	92.79	180.05
4.0	1.000	0.375	18	5	15.92	89.83	174.34
4.0	1.000	0.375	19	5	15.62	87.35	169.56
4.0	1.000	0.375	20	5	15.34	84.73	164.52
4.0	1.000	0.375	21	5	15.08	82.51	160.23
4.0	1.000	0.500	12	4	13.67	70.10	136.50
4.0	1.000	0.500	13	4	13.25	66.60	129.76
4.0	1.000	0.500	14	4	12.87	63.06	122.96
4.0	1.000	0.500	15	4	12.53	60.19	117.44
4.0	1.000	0.500	16	4	12.23	57.29	111.89
4.0	1.000	0.625	11	4	10.96	47.20	92.88
4.0	1.000	0.625	12	4	10.60	43.84	86.47
4.0	1.000	0.625	13	4	10.28	41.09	81.20
4.0	1.000	0.625	14	4	10.01	38.52	76.30

PLATE AREA - 1000.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.750	7	7	44.06	77.99	184.49	1.0	1.000	0.750	6	8	15.28	74.42	147.31
1.0	0.500	0.750	8	7	45.97	77.85	186.05	1.0	1.000	0.750	7	8	15.06	48.31	135.88
1.0	0.500	0.750	7	8	45.81	77.85	186.05	1.0	1.000	0.750	8	8	14.86	59.58	119.07
1.0	0.500	0.750	8	8	45.72	66.25	162.97								
1.0	0.625	0.750	6	6	31.39	89.98	190.83	1.2	0.500	0.750	8	6	52.36	72.76	182.50
1.0	0.625	0.750	7	6	31.34	89.16	189.05	1.2	0.500	0.750	9	6	52.23	78.03	176.15
1.0	0.625	0.750	8	6	31.21	88.66	187.93	1.2	0.500	0.750	8	7	52.20	72.72	182.24
1.0	0.625	0.750	6	7	31.11	89.16	189.05	1.2	0.500	0.750	9	7	52.07	63.53	165.53
1.0	0.625	0.750	7	7	31.03	77.93	168.60	1.2	0.625	0.750	7	6	35.38	85.29	186.26
1.0	0.625	0.750	8	7	30.89	77.53	167.68	1.2	0.625	0.750	8	6	35.15	73.20	162.64
1.0	0.625	0.750	6	8	30.81	88.66	187.93	1.2	0.625	0.750	9	6	34.97	75.87	159.20
1.0	0.625	0.750	7	8	30.73	77.53	167.68	1.2	0.625	0.750	7	7	35.14	85.09	185.69
1.0	0.625	0.750	8	8	30.59	66.18	145.52	1.2	0.625	0.750	8	7	34.90	72.91	161.93
1.0	0.750	0.750	6	6	23.66	86.61	176.90	1.2	0.625	0.750	9	7	34.72	64.54	146.39
1.0	0.750	0.750	7	6	23.49	85.53	174.63	1.2	0.750	0.750	7	6	26.33	83.81	174.03
1.0	0.750	0.750	8	6	23.31	84.76	173.02	1.2	0.750	0.750	8	6	26.04	72.04	151.23
1.0	0.750	0.750	6	7	23.25	85.53	174.63	1.2	0.750	0.750	9	6	25.82	72.23	146.57
1.0	0.750	0.750	7	7	23.09	76.10	157.22	1.2	0.750	0.750	7	7	26.02	83.22	172.74
1.0	0.750	0.750	8	7	22.92	75.44	155.81	1.2	0.750	0.750	8	7	25.74	71.52	150.10
1.0	0.750	0.750	6	8	22.90	84.76	173.02	1.2	0.750	0.750	9	7	25.52	64.04	136.08
1.0	0.750	0.750	7	8	22.74	75.44	155.81	1.2	0.875	0.750	7	6	20.99	80.87	163.59
1.0	0.750	0.750	8	8	22.58	64.73	135.07	1.2	0.875	0.750	8	6	20.67	69.86	142.35
1.0	0.875	0.750	6	6	19.09	82.30	164.81	1.2	0.875	0.750	9	6	20.42	67.82	135.25
1.0	0.875	0.750	7	6	18.85	80.90	161.96	1.2	0.875	0.750	7	7	20.65	79.98	161.76
1.0	0.875	0.750	8	6	18.65	79.85	159.83	1.2	0.875	0.750	8	7	20.34	69.13	140.82
1.0	0.875	0.750	6	7	18.63	80.90	161.96	1.2	0.875	0.750	9	7	20.10	62.55	128.44
1.0	0.875	0.750	7	7	18.41	73.14	147.51	1.2	1.000	0.625	9	6	19.47	98.54	193.93
1.0	0.875	0.750	8	7	18.22	72.23	145.64	1.2	1.000	0.625	9	7	19.04	96.88	190.65
1.0	0.875	0.750	6	8	18.25	79.85	159.83	1.2	1.000	0.750	7	6	17.58	76.93	153.34
1.0	0.875	0.750	7	8	18.05	72.23	145.64	1.2	1.000	0.750	8	6	17.24	66.94	134.11
1.0	0.875	0.750	8	8	17.87	62.44	126.75	1.2	1.000	0.750	9	6	16.97	63.09	124.57
1.0	1.000	0.625	8	8	17.12	94.48	185.37	1.2	1.000	0.750	7	7	17.22	75.82	151.10
1.0	1.000	0.750	6	6	16.14	77.39	153.25	1.2	1.000	0.750	8	7	16.90	66.03	132.25
1.0	1.000	0.750	7	6	15.87	75.72	149.91	1.2	1.000	0.750	9	7	16.64	60.34	121.49
1.0	1.000	0.750	8	6	15.66	74.42	147.31								
1.0	1.000	0.750	6	7	15.66	75.72	149.91	1.4	0.500	0.750	8	6	53.59	75.15	190.30
1.0	1.000	0.750	7	7	15.42	69.43	138.15	1.4	0.500	0.750	9	6	53.40	64.94	171.41
1.0	1.000	0.750	8	7	15.22	68.31	135.88	1.4	0.500	0.750	8	7	53.48	75.11	190.10

PLATE AREA - 1000.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.4	0.500	0.750	9	7	53.28	65.09	171.54	1.6	0.625	0.750	10	6	34.39	58.77	137.05
1.4	0.625	0.750	7	6	36.29	87.73	192.44	1.6	0.750	0.750	8	5	26.29	74.59	157.20
1.4	0.625	0.750	8	6	35.96	75.60	168.83	1.6	0.750	0.750	9	5	25.92	65.89	140.70
1.4	0.625	0.750	9	6	35.70	66.32	151.45	1.6	0.750	0.750	10	5	25.63	67.40	134.11
1.4	0.625	0.750	7	7	36.10	87.54	191.94	1.6	0.750	0.750	8	6	25.98	74.22	156.40
1.4	0.625	0.750	8	7	35.78	75.40	168.33	1.6	0.750	0.750	9	6	25.61	65.50	139.87
1.4	0.625	0.750	9	7	35.53	66.22	151.13	1.6	0.750	0.750	10	6	25.32	58.59	126.59
1.4	0.750	0.750	7	6	27.02	86.27	179.56	1.6	0.875	0.625	10	5	22.79	96.03	191.35
1.4	0.750	0.750	8	6	26.63	74.37	156.53	1.6	0.875	0.625	10	6	22.44	95.19	189.67
1.4	0.750	0.750	9	6	26.33	66.08	140.91	1.6	0.875	0.750	8	5	21.01	72.34	147.73
1.4	0.750	0.750	7	7	26.79	85.81	178.57	1.6	0.875	0.750	9	5	20.60	64.66	133.13
1.4	0.750	0.750	8	7	26.41	74.00	155.73	1.6	0.875	0.750	10	5	20.27	61.59	121.28
1.4	0.750	0.750	9	7	26.11	65.78	140.23	1.6	0.875	0.750	8	6	20.71	71.85	146.70
1.4	0.875	0.750	7	6	21.57	83.25	168.62	1.6	0.875	0.750	9	6	20.31	64.16	132.11
1.4	0.875	0.750	8	6	21.14	72.02	146.98	1.6	0.875	0.750	10	6	19.99	57.49	119.27
1.4	0.875	0.750	9	6	20.81	64.72	133.17	1.6	1.000	0.625	9	5	19.93	100.31	197.49
1.4	0.875	0.750	7	7	21.32	82.58	167.24	1.6	1.000	0.625	10	5	19.41	90.79	179.16
1.4	0.875	0.750	8	7	20.90	71.50	145.89	1.6	1.000	0.625	9	6	19.61	99.18	195.26
1.4	0.875	0.750	9	7	20.57	64.27	132.20	1.6	1.000	0.625	10	6	19.10	89.86	177.31
1.4	1.000	0.625	9	6	19.88	100.36	197.58	1.6	1.000	0.750	8	5	17.64	69.25	138.88
1.4	1.000	0.625	9	7	19.55	99.14	195.16	1.6	1.000	0.750	9	5	17.20	62.55	126.14
1.4	1.000	0.750	7	6	18.09	79.12	157.82	1.6	1.000	0.750	10	5	16.85	56.17	113.87
1.4	1.000	0.750	8	6	17.64	68.88	138.10	1.6	1.000	0.750	8	6	17.36	68.64	137.64
1.4	1.000	0.750	9	6	17.29	62.54	126.08	1.6	1.000	0.750	9	6	16.94	61.97	124.96
1.4	1.000	0.750	7	7	17.83	78.29	156.14	1.6	1.000	0.750	10	6	16.60	55.71	112.93
1.4	1.000	0.750	8	7	17.40	68.22	136.76	1.8	0.500	0.750	8	5	49.23	73.47	187.25
1.4	1.000	0.750	9	7	17.05	61.96	124.88	1.8	0.500	0.750	9	5	48.94	62.61	166.30
1.6	0.500	0.750	8	5	52.28	75.10	191.10	1.8	0.500	0.750	10	5	48.72	56.20	154.09
1.6	0.500	0.750	9	5	52.04	64.44	170.96	1.8	0.500	0.750	11	5	48.55	68.61	143.58
1.6	0.500	0.750	10	5	51.85	77.13	163.67	1.8	0.500	0.750	8	6	48.94	73.37	186.98
1.6	0.500	0.750	8	6	51.94	74.97	190.74	1.8	0.500	0.750	9	6	48.66	62.46	165.96
1.6	0.500	0.750	9	6	51.70	64.32	170.63	1.8	0.500	0.750	10	6	48.44	56.11	153.86
1.6	0.500	0.750	10	6	51.51	57.53	157.45	1.8	0.500	0.750	11	6	48.26	49.40	140.83
1.6	0.625	0.750	8	5	35.28	75.69	169.46	1.8	0.625	0.625	11	6	34.16	89.30	189.06
1.6	0.625	0.750	9	5	34.97	65.97	151.06	1.8	0.625	0.750	8	5	33.35	74.04	169.89
1.6	0.625	0.750	10	5	34.72	72.86	147.92	1.8	0.625	0.750	9	5	32.99	64.11	146.85
1.6	0.625	0.750	8	6	34.95	75.45	168.89	1.8	0.625	0.750	10	5	32.71	57.48	134.16
1.6	0.625	0.750	9	6	34.64	65.72	150.47	1.8	0.625	0.750	11	5	32.49	64.38	129.72

PLATE AREA - 1000.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.8	0.625	0.750	8	6	33.08	73.86	165.45	1.8	1.000	0.750	8	6	16.73	67.13	134.58
1.8	0.625	0.750	9	6	32.73	63.87	146.33	1.8	1.000	0.750	9	6	16.26	60.29	121.54
1.8	0.625	0.750	10	6	32.45	57.33	133.81	1.8	1.000	0.750	10	6	15.88	54.29	110.03
1.8	0.625	0.750	11	6	32.22	51.02	121.70	1.8	1.000	0.750	11	6	15.57	49.55	100.97
1.8	0.750	0.625	10	5	26.65	97.30	197.28								
1.8	0.750	0.625	11	5	26.21	92.30	180.41	2.0	0.500	0.625	11	6	46.35	85.44	196.50
1.8	0.750	0.625	10	6	26.34	96.81	196.28	2.0	0.500	0.750	9	5	45.42	60.23	159.81
1.8	0.750	0.625	11	6	25.91	87.82	179.03	2.0	0.500	0.750	10	5	45.18	54.29	148.74
1.8	0.750	0.750	8	5	24.98	72.92	153.71	2.0	0.500	0.750	11	5	44.99	47.61	135.52
1.8	0.750	0.750	9	5	24.56	64.02	136.73	2.0	0.500	0.750	9	6	45.16	60.06	159.44
1.8	0.750	0.750	10	5	24.23	57.36	123.95	2.0	0.500	0.750	10	6	44.92	54.20	148.53
1.8	0.750	0.750	11	5	23.96	59.12	117.11	2.0	0.500	0.750	11	6	44.73	47.49	135.25
1.8	0.750	0.750	8	6	24.73	72.66	153.16	2.0	0.625	0.625	11	5	32.25	93.75	184.04
1.8	0.750	0.750	9	6	24.32	63.70	136.05	2.0	0.625	0.625	11	6	31.96	85.87	181.79
1.8	0.750	0.750	10	6	23.99	57.15	123.48	2.0	0.625	0.750	9	5	30.75	61.69	141.21
1.8	0.750	0.750	11	6	23.73	51.32	112.34	2.0	0.625	0.750	10	5	30.45	55.51	129.48
1.8	0.875	0.625	10	5	21.79	93.26	185.82	2.0	0.625	0.750	11	5	30.21	49.24	117.34
1.8	0.875	0.625	11	5	21.53	85.42	170.78	2.0	0.625	0.750	9	6	30.53	61.45	140.72
1.8	0.875	0.625	10	6	21.33	92.66	184.63	2.0	0.625	0.750	10	6	30.22	55.38	129.19
1.8	0.875	0.625	11	6	21.07	84.83	169.61	2.0	0.625	0.750	11	6	29.98	49.07	116.96
1.8	0.875	0.750	8	5	20.07	70.66	144.29	2.0	0.750	0.625	10	5	25.11	93.78	190.12
1.8	0.875	0.750	9	5	19.61	62.82	129.32	2.0	0.750	0.625	11	5	24.65	84.87	172.98
1.8	0.875	0.750	10	5	19.25	56.34	116.88	2.0	0.750	0.625	10	6	24.86	93.42	189.38
1.8	0.875	0.750	11	5	18.95	51.06	106.80	2.0	0.750	0.625	11	6	24.40	84.45	172.14
1.8	0.875	0.750	8	6	19.84	70.32	143.58	2.0	0.750	0.750	9	5	23.02	61.62	131.52
1.8	0.875	0.750	9	6	19.39	62.43	128.52	2.0	0.750	0.750	10	5	22.67	55.37	119.59
1.8	0.875	0.750	10	6	19.03	56.06	116.30	2.0	0.750	0.750	11	5	22.38	49.60	108.48
1.8	0.875	0.750	11	6	18.74	50.77	106.19	2.0	0.750	0.750	9	6	22.82	61.33	130.92
1.8	1.000	0.625	9	5	19.23	97.12	191.18	2.0	0.750	0.750	10	6	22.47	55.20	119.22
1.8	1.000	0.625	10	5	18.67	88.00	173.61	2.0	0.750	0.750	11	6	22.19	49.38	108.02
1.8	1.000	0.625	11	5	18.19	81.29	160.74	2.0	0.875	0.625	9	5	21.27	99.43	197.41
1.8	1.000	0.625	9	6	18.98	96.28	189.53	2.0	0.875	0.625	10	5	20.67	89.76	178.81
1.8	1.000	0.625	10	6	18.43	87.33	172.29	2.0	0.875	0.625	11	5	20.18	82.00	163.91
1.8	1.000	0.625	11	6	17.96	80.65	159.49	2.0	0.875	0.625	9	6	21.04	98.82	196.20
1.8	1.000	0.750	8	5	16.94	67.55	135.45	2.0	0.875	0.625	10	6	20.46	89.33	177.95
1.8	1.000	0.750	9	5	16.46	60.73	122.43	2.0	0.875	0.625	11	6	19.97	81.54	162.99
1.8	1.000	0.750	10	5	16.08	54.62	110.70	2.0	0.875	0.750	9	5	18.49	60.45	124.38
1.8	1.000	0.750	11	5	15.76	49.88	101.65	2.0	0.875	0.750	10	5	18.10	54.35	112.69

PLATE AREA - 1000.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
2.0	0.875	0.750	11	5	17.79	49.10	102.64	4.0	0.625	0.625	16	4	17.52	46.73	90.56
2.0	0.875	0.750	9	6	18.31	60.12	123.72	4.0	0.625	0.750	12	4	16.43	32.59	76.42
2.0	0.875	0.750	10	6	17.93	54.14	112.25	4.0	0.625	0.750	13	4	16.27	29.58	70.39
2.0	0.875	0.750	11	6	17.62	48.89	102.13	4.0	0.625	0.750	14	4	16.23	27.52	66.68
2.0	1.000	0.625	9	5	18.41	93.16	183.33	4.0	0.625	0.750	15	4	16.07	32.56	63.20
2.0	1.000	0.625	10	5	17.81	84.53	166.74	4.0	0.625	0.750	16	4	16.33	32.28	62.66
2.0	1.000	0.625	11	5	17.31	77.92	154.05	4.0	0.750	0.500	12	4	18.50	96.19	189.29
2.0	1.000	0.625	9	6	18.21	92.52	182.07	4.0	0.750	0.500	13	4	17.97	89.85	177.07
2.0	1.000	0.625	10	6	17.63	84.05	165.78	4.0	0.750	0.500	14	4	17.52	84.05	165.96
2.0	1.000	0.625	11	6	17.14	77.44	153.09	4.0	0.750	0.500	15	4	17.11	79.18	156.58
2.0	1.000	0.750	9	5	15.62	58.41	117.68	4.0	0.750	0.500	16	4	16.76	74.65	147.88
2.0	1.000	0.750	10	5	15.21	52.63	106.61	4.0	0.750	0.625	12	4	14.78	54.11	109.93
2.0	1.000	0.750	11	5	14.88	47.94	97.63	4.0	0.750	0.625	13	4	14.46	49.99	101.99
2.0	1.000	0.750	9	6	15.46	58.05	116.98	4.0	0.750	0.625	14	4	14.18	46.55	95.46
2.0	1.000	0.750	10	6	15.06	52.39	106.12	4.0	0.750	0.625	15	4	13.94	43.49	89.57
2.0	1.000	0.750	11	6	14.72	47.67	97.09	4.0	0.750	0.625	16	4	13.74	40.85	84.55
4.0	0.500	0.500	14	4	28.14	93.41	194.01	4.0	0.750	0.750	12	4	12.73	32.43	70.18
4.0	0.500	0.500	15	4	27.81	93.98	182.19	4.0	0.750	0.750	13	4	12.54	29.70	64.87
4.0	0.500	0.500	16	4	27.52	92.88	180.06	4.0	0.750	0.750	14	4	12.37	27.62	61.00
4.0	0.500	0.625	12	4	25.34	56.40	128.88	4.0	0.750	0.750	15	4	12.23	25.63	57.14
4.0	0.500	0.625	13	4	25.11	61.03	118.51	4.0	0.875	0.500	12	4	12.10	24.04	54.18
4.0	0.500	0.625	14	4	24.91	60.48	117.45	4.0	0.875	0.500	13	4	15.65	81.29	159.02
4.0	0.500	0.625	15	4	24.75	60.01	116.52	4.0	0.875	0.500	14	4	15.22	76.48	149.78
4.0	0.500	0.625	16	4	24.60	59.59	115.71	4.0	0.875	0.500	15	4	14.82	72.52	142.17
4.0	0.500	0.750	12	4	25.66	31.77	87.88	4.0	0.875	0.500	16	4	14.47	68.67	134.78
4.0	0.500	0.750	13	4	24.97	28.49	80.81	4.0	0.875	0.625	12	4	12.60	51.10	101.83
4.0	0.500	0.750	14	4	25.57	26.53	77.62	4.0	0.875	0.625	13	4	12.27	47.56	95.04
4.0	0.500	0.750	15	4	25.06	39.52	77.06	4.0	0.875	0.625	14	4	11.98	44.41	89.03
4.0	0.500	0.750	16	4	25.50	39.34	76.70	4.0	0.875	0.625	15	4	11.72	41.72	83.88
4.0	0.625	0.500	13	4	21.65	96.58	193.11	4.0	0.875	0.625	16	4	11.50	39.27	79.20
4.0	0.625	0.500	14	4	21.21	90.01	180.53	4.0	0.875	0.750	12	4	10.55	31.59	65.51
4.0	0.625	0.500	15	4	20.83	84.22	169.37	4.0	0.875	0.750	13	4	10.33	29.15	60.81
4.0	0.625	0.500	16	4	20.50	79.15	159.66	4.0	0.875	0.750	14	4	10.15	27.13	57.00
4.0	0.625	0.625	12	4	18.43	56.02	118.13	4.0	1.000	0.375	17	4	17.16	100.44	194.89
4.0	0.625	0.625	13	4	18.15	51.31	108.96	4.0	1.000	0.375	18	4	16.83	97.20	188.65
4.0	0.625	0.625	14	4	17.91	47.74	102.25	4.0	1.000	0.375	19	4	16.51	94.55	183.53
4.0	0.625	0.625	15	4	17.70	44.31	95.58	4.0	1.000	0.375	20	4	16.22	91.69	178.03

PLATE AREA - 1000.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
4.0	1.000	0.375	21	4	15.94	89.31	173.42
4.0	1.000	0.375	17	5	17.08	100.21	194.46
4.0	1.000	0.375	18	5	16.75	97.01	188.29
4.0	1.000	0.375	19	5	16.44	94.34	183.12
4.0	1.000	0.375	20	5	16.15	91.51	177.68
4.0	1.000	0.375	21	5	15.87	89.11	173.04
4.0	1.000	0.500	12	4	14.39	75.71	147.39
4.0	1.000	0.500	13	4	13.95	71.92	140.11
4.0	1.000	0.500	14	4	13.55	68.10	132.76
4.0	1.000	0.500	15	4	13.19	65.00	126.80
4.0	1.000	0.500	16	4	12.87	61.87	120.80
4.0	1.000	0.625	12	4	11.16	47.34	93.31
4.0	1.000	0.625	13	4	10.83	44.37	87.61
4.0	1.000	0.625	14	4	10.53	41.59	82.32
4.0	1.000	0.625	15	4	10.28	39.29	77.90
4.0	1.000	0.625	16	4	10.05	37.10	73.71

APPENDIX B

Stresses In Bolted Aluminum Covers

Static Design Pressure = 150 psig

Cover Properties:

$$E = 10 \times 10^6 \text{ psi}$$

$$\nu = 0.33$$

Bolt Properties:

$$E = 29 \times 10^6 \text{ psi}$$

$$\nu = 0.3$$

PLATE AREA - 50.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.250	0.250	3	3	15.52	59.79	141.59
1.0	0.250	0.375	2	2	27.96	23.20	85.55
1.0	0.250	0.500	2	2	24.83	6.50	73.83
1.0	0.250	0.625	2	2	20.43	3.28	47.12
1.0	0.250	0.750	2	2	16.11	2.64	24.05
1.0	0.375	0.375	2	2	13.10	21.43	51.01
1.0	0.375	0.500	2	2	11.63	9.74	39.12
1.2	0.250	0.250	3	2	25.01	81.40	199.92
1.2	0.250	0.375	3	2	28.82	21.39	117.01
1.2	0.250	0.625	2	2	20.87	3.18	52.75
1.2	0.250	0.750	2	2	15.79	2.52	30.01
1.2	0.375	0.375	3	2	12.64	24.07	68.94
1.2	0.375	0.625	2	2	10.17	4.88	30.71
1.4	0.250	0.250	3	2	25.49	77.38	193.57
1.4	0.250	0.375	3	2	27.83	20.36	113.51
1.4	0.375	0.375	3	2	12.34	23.03	66.79
1.6	0.250	0.250	3	2	25.12	72.80	184.63
1.6	0.250	0.375	3	2	26.13	19.27	107.80
1.6	0.375	0.375	3	2	11.68	21.80	63.57
1.8	0.250	0.250	3	2	24.22	68.15	174.56
1.8	0.250	0.375	3	2	24.12	18.22	101.09
1.8	0.375	0.375	3	2	10.82	20.55	59.87
2.0	0.250	0.250	3	2	23.01	63.67	164.17
2.0	0.250	0.250	4	2	12.49	48.05	116.80
2.0	0.250	0.375	3	2	22.03	17.23	94.05

PLATE AREA - 100.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.250	0.375	3	3	33.69	47.28	175.27
1.0	0.250	0.500	3	3	34.35	14.61	149.01
1.0	0.250	0.625	3	3	24.04	4.51	113.15
1.0	0.375	0.250	4	4	13.21	98.82	198.12
1.0	0.375	0.375	3	3	14.27	50.03	120.71
1.0	0.375	0.500	3	3	16.37	20.07	76.20
1.0	0.375	0.625	3	3	14.59	8.88	60.25
1.2	0.250	0.375	3	3	39.07	48.32	193.06
1.2	0.250	0.375	4	3	22.44	34.89	130.74
1.2	0.375	0.375	3	3	16.63	51.72	128.59
1.2	0.375	0.375	4	3	10.07	37.34	90.73
1.4	0.250	0.375	4	3	23.51	35.47	135.24
1.4	0.375	0.375	3	3	17.94	51.92	131.81
1.4	0.375	0.375	4	3	10.36	37.94	92.97
1.6	0.250	0.375	4	3	23.67	35.40	135.98
1.6	0.250	0.750	3	2	33.32	4.86	67.31
1.6	0.375	0.375	3	3	18.39	51.07	131.43
1.6	0.375	0.375	4	3	10.50	37.77	93.03
1.6	0.375	0.750	3	2	14.41	6.29	51.39
1.8	0.250	0.375	4	3	23.25	34.94	134.34
1.8	0.250	0.375	5	3	23.56	30.70	128.84
1.8	0.250	0.500	3	2	44.59	16.16	188.98
1.8	0.250	0.625	3	2	31.97	7.22	119.01
1.8	0.250	0.750	3	2	30.32	5.12	58.20
1.8	0.375	0.375	4	3	10.37	37.15	91.72
1.8	0.375	0.375	5	3	10.13	33.23	84.43
1.8	0.375	0.500	3	2	22.63	22.96	99.32
1.8	0.375	0.625	3	2	17.19	10.80	72.63
1.8	0.375	0.750	3	2	13.39	6.24	49.60
1.8	0.500	0.500	3	2	12.47	24.39	70.14
1.8	0.500	0.625	3	2	10.74	12.39	49.14
2.0	0.250	0.375	4	2	24.13	37.81	143.80
2.0	0.250	0.375	5	2	22.40	29.90	124.39
2.0	0.250	0.500	4	2	19.45	13.17	102.57
2.0	0.250	0.625	4	2	18.56	6.00	66.15
2.0	0.250	0.750	3	2	27.48	1.01	57.16
2.0	0.375	0.375	4	2	11.12	40.29	99.37
2.0	0.375	0.750	3	2	12.27	6.14	40.56

PLATE AREA - 150.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.250	0.375	4	4	34.21	54.36	173.39	1.4	0.500	0.375	4	4	11.47	62.75	131.97
1.0	0.250	0.750	3	3	35.73	1.94	153.89	1.4	0.500	0.375	5	4	10.08	60.70	127.82
1.0	0.375	0.375	4	3	13.37	80.55	181.10								
1.0	0.375	0.375	3	4	14.88	80.55	181.10	1.6	0.250	0.500	4	3	33.65	22.23	172.83
1.0	0.375	0.375	4	4	16.49	57.15	130.50	1.6	0.375	0.375	4	3	15.37	69.21	161.03
1.0	0.375	0.500	3	3	23.29	37.56	124.62	1.6	0.375	0.375	5	3	14.65	63.14	150.48
1.0	0.375	0.625	3	3	24.00	16.70	100.73	1.6	0.375	0.500	4	3	16.15	28.33	96.25
1.0	0.375	0.750	3	3	20.17	7.67	85.58	1.6	0.500	0.375	4	3	10.07	66.41	139.18
1.0	0.500	0.375	4	4	10.26	55.44	115.16								
1.0	0.500	0.500	3	3	12.58	38.69	96.07	1.8	0.250	0.375	6	3	31.81	43.65	175.75
1.0	0.500	0.625	3	3	13.82	19.20	66.86	1.8	0.375	0.375	4	3	14.69	67.90	158.74
1.0	0.500	0.750	3	3	12.95	10.19	54.08	1.8	0.375	0.375	5	3	13.97	61.81	146.76
								1.8	0.375	0.375	6	3	13.83	47.31	118.21
1.2	0.250	0.375	4	4	37.58	59.97	199.40								
1.2	0.250	0.750	3	3	41.75	2.71	160.16	2.0	0.250	0.375	6	3	30.42	42.58	170.14
1.2	0.375	0.375	4	3	15.26	68.89	157.68	2.0	0.375	0.375	4	3	14.51	66.16	155.21
1.2	0.375	0.375	5	3	14.53	68.33	150.14	2.0	0.375	0.375	5	3	13.10	59.99	141.68
1.2	0.375	0.375	4	4	18.07	62.82	145.84	2.0	0.375	0.375	6	3	13.20	46.02	114.64
1.2	0.375	0.375	5	4	16.07	61.50	144.29								
1.2	0.375	0.500	3	3	26.92	38.67	136.40								
1.2	0.375	0.625	3	3	27.08	17.25	112.51								
1.2	0.375	0.750	3	3	21.96	8.17	93.98								
1.2	0.500	0.375	4	4	11.24	60.44	126.51								
1.2	0.500	0.375	5	4	10.04	58.93	123.74								
1.2	0.500	0.500	3	3	14.59	40.11	102.81								
1.2	0.500	0.625	3	3	15.72	20.03	73.46								
1.2	0.500	0.750	3	3	14.33	10.78	59.81								
1.4	0.250	0.500	4	3	34.13	22.07	173.46								
1.4	0.250	0.625	4	3	31.47	6.88	150.14								
1.4	0.250	0.750	4	3	33.97	2.88	105.12								
1.4	0.375	0.375	4	3	15.70	69.73	161.11								
1.4	0.375	0.375	5	3	14.93	63.45	151.48								
1.4	0.375	0.375	4	4	18.32	65.54	153.72								
1.4	0.375	0.375	5	4	16.08	63.49	149.53								
1.4	0.375	0.500	4	3	16.15	28.34	95.98								
1.4	0.375	0.625	4	3	15.47	12.84	76.10								
1.4	0.375	0.750	4	3	14.22	6.32	62.13								
1.4	0.500	0.375	4	3	10.21	67.09	140.13								

PLATE AREA - 200.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT		B/A	H	DB	NB	NA	PLATE	BOLT	
						AXIAL	TOTAL							AXIAL	TOTAL
1.0	0.500	0.375	4	4	13.94	85.55	175.05	1.6	0.625	0.375	4	3	10.35	93.27	186.42
1.0	0.500	0.375	5	4	12.55	83.79	172.40	1.6	0.625	0.375	4	4	11.19	88.44	177.26
1.0	0.500	0.375	4	5	12.34	83.79	172.40	1.8	0.500	0.375	5	3	11.05	92.07	190.93
1.0	0.500	0.375	5	5	11.11	80.94	166.78	1.8	0.500	0.375	6	3	10.68	71.80	151.79
1.0	0.500	0.500	4	4	12.07	36.90	87.85	1.8	0.500	0.375	4	4	14.71	95.72	199.02
1.0	0.500	0.625	4	4	11.01	18.17	58.67	1.8	0.500	0.375	5	4	12.39	91.66	189.37
1.0	0.500	0.750	3	3	18.23	15.87	77.84	1.8	0.500	0.375	6	4	11.93	71.47	151.14
1.0	0.625	0.375	4	4	10.05	79.34	157.94	1.8	0.500	0.500	4	3	11.54	44.24	107.49
1.0	0.625	0.750	3	3	11.78	17.24	57.83	1.8	0.500	0.500	5	3	11.19	39.80	99.06
1.2	0.500	0.375	5	3	11.80	98.10	197.97	1.8	0.500	0.625	4	3	11.77	22.40	72.31
1.2	0.500	0.375	4	4	15.26	93.00	191.54	1.8	0.500	0.625	5	3	11.92	19.47	67.88
1.2	0.500	0.375	5	4	13.45	91.26	188.43	1.8	0.500	0.750	4	3	10.51	12.36	56.19
1.2	0.500	0.500	4	3	11.36	44.61	106.39	1.8	0.500	0.750	5	3	10.81	10.25	53.85
1.2	0.500	0.625	4	3	11.90	22.14	71.44	1.8	0.625	0.375	4	3	10.09	90.81	181.67
1.2	0.500	0.750	4	3	11.77	11.79	57.90	1.8	0.625	0.375	4	4	10.87	87.05	174.64
1.2	0.625	0.375	4	3	10.05	96.02	189.60	2.0	0.500	0.375	5	3	10.42	89.05	184.34
1.2	0.625	0.375	4	4	11.00	85.63	171.01	2.0	0.500	0.375	6	3	10.04	69.59	147.00
1.4	0.500	0.375	5	3	11.96	95.21	197.81	2.0	0.500	0.500	5	3	10.38	38.66	95.43
1.4	0.500	0.375	6	3	11.64	83.21	166.61	2.0	0.500	0.500	5	3	10.84	19.02	64.57
1.4	0.500	0.375	4	4	15.58	96.37	199.35								
1.4	0.500	0.375	5	4	13.50	94.00	194.36								
1.4	0.500	0.375	6	4	13.17	72.54	153.36								
1.4	0.500	0.500	4	3	11.64	45.26	108.95								
1.4	0.500	0.625	4	3	12.28	22.63	73.50								
1.4	0.500	0.750	4	3	11.75	12.20	58.97								
1.4	0.625	0.375	4	3	10.41	94.62	188.81								
1.4	0.625	0.375	4	4	11.30	88.30	176.71								
1.6	0.500	0.375	5	3	11.61	94.36	195.94								
1.6	0.500	0.375	6	3	11.26	73.51	155.45								
1.6	0.500	0.375	5	4	13.06	93.69	193.73								
1.6	0.500	0.375	6	4	12.65	72.69	153.75								
1.6	0.500	0.500	4	3	11.62	45.02	107.00								
1.6	0.500	0.500	5	3	11.85	40.60	101.75								
1.6	0.500	0.625	4	3	12.18	22.65	73.53								
1.6	0.500	0.625	5	3	12.89	19.75	70.52								
1.6	0.500	0.750	4	3	11.25	12.36	58.11								

PLATE AREA - 250.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.500	4	4	15.37	51.80	119.34	1.8	0.500	0.375	7	4	14.59	87.00	183.25
1.0	0.500	0.625	4	4	14.04	25.63	77.46	1.8	0.500	0.500	5	3	13.32	56.00	134.32
1.0	0.500	0.750	4	4	13.17	13.61	62.04	1.8	0.500	0.625	5	3	14.85	27.57	90.25
1.0	0.625	0.500	4	4	10.59	50.90	107.86	1.8	0.500	0.750	5	3	14.43	14.51	72.36
1.2	0.500	0.500	4	4	16.86	56.99	133.54	1.8	0.625	0.375	6	3	10.18	94.68	190.14
1.2	0.500	0.625	4	4	15.47	28.48	88.73	1.8	0.625	0.375	6	4	11.03	93.65	188.10
1.2	0.500	0.750	4	4	14.61	15.23	71.93	1.8	0.625	0.375	7	4	10.62	82.79	167.27
1.2	0.625	0.375	6	4	11.95	93.02	186.73	2.0	0.500	0.375	7	3	12.16	84.31	178.14
1.2	0.625	0.375	6	5	10.97	91.54	183.59	2.0	0.500	0.375	8	3	11.91	80.73	158.52
1.2	0.625	0.500	4	4	11.61	55.66	119.04	2.0	0.500	0.375	7	4	13.61	83.46	175.76
1.2	0.625	0.625	4	4	10.41	29.11	73.26	2.0	0.500	0.500	8	4	13.32	71.72	153.52
1.2	0.750	0.375	4	5	10.10	101.60	199.44	2.0	0.500	0.500	5	3	12.46	54.36	129.62
1.4	0.500	0.500	4	3	14.68	63.28	147.50	2.0	0.500	0.500	6	3	12.56	41.69	109.10
1.4	0.500	0.500	5	3	14.29	57.45	138.70	2.0	0.500	0.625	5	3	13.68	26.88	86.31
1.4	0.500	0.625	4	3	15.04	31.73	97.14	2.0	0.500	0.625	6	3	13.54	20.25	72.91
1.4	0.500	0.625	5	3	16.43	28.02	94.33	2.0	0.500	0.750	5	3	12.98	14.29	67.97
1.4	0.500	0.750	4	3	15.12	17.13	77.61	2.0	0.500	0.750	6	3	12.59	10.53	59.13
1.4	0.500	0.750	5	3	16.74	14.46	78.16	2.0	0.625	0.375	6	4	10.44	90.86	182.41
1.4	0.625	0.375	6	4	11.95	95.74	192.31	2.0	0.625	0.375	7	4	10.01	79.51	160.57
1.4	0.625	0.375	6	5	11.20	94.73	190.16								
1.4	0.625	0.500	4	3	10.44	61.81	131.84								
1.4	0.625	0.625	5	3	10.26	28.88	76.06								
1.4	0.625	0.750	5	3	10.89	15.95	57.10								
1.6	0.500	0.375	7	3	13.72	100.73	199.40								
1.6	0.500	0.375	7	4	15.92	89.96	189.39								
1.6	0.500	0.500	5	3	13.99	57.19	137.77								
1.6	0.500	0.625	5	3	15.85	28.03	93.27								
1.6	0.500	0.750	4	3	14.76	17.24	77.16								
1.6	0.500	0.750	5	3	15.77	14.61	76.11								
1.6	0.625	0.375	6	3	10.63	97.33	195.51								
1.6	0.625	0.375	7	3	10.26	86.23	174.67								
1.6	0.625	0.375	6	4	11.57	95.54	191.94								
1.6	0.625	0.375	7	4	11.19	85.46	172.67								
1.6	0.625	0.750	5	3	10.27	16.01	56.05								
1.8	0.500	0.375	7	3	12.97	87.56	185.20								

PLATE AREA - 300.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.500	4	4	18.72	68.36	153.75	1.8	0.500	0.500	5	3	15.20	74.01	172.62
1.0	0.500	0.625	4	4	17.14	33.97	97.44	1.8	0.500	0.500	6	3	15.04	56.67	138.53
1.0	0.500	0.750	4	4	16.04	18.16	76.71	1.8	0.500	0.625	5	3	17.46	36.64	113.71
1.0	0.625	0.500	4	4	12.88	67.04	140.27	1.8	0.500	0.625	6	3	17.01	27.57	94.82
1.0	0.625	0.625	4	4	11.54	34.68	83.10	1.8	0.500	0.750	5	3	17.74	19.37	90.99
1.0	0.625	0.750	4	4	10.69	19.52	59.25	1.8	0.500	0.750	6	3	17.01	14.21	78.49
1.2	0.500	0.500	4	4	20.51	75.03	171.44	1.8	0.625	0.375	8	3	11.38	99.62	194.28
1.2	0.500	0.500	5	4	18.13	73.74	169.87	1.8	0.625	0.375	8	4	12.40	93.80	189.76
1.2	0.500	0.625	4	4	18.85	37.63	111.29	1.8	0.625	0.500	5	3	10.16	72.19	153.89
1.2	0.500	0.625	5	4	17.18	36.51	111.59	1.8	0.625	0.625	6	3	10.82	37.38	93.72
1.2	0.500	0.750	4	4	17.75	20.23	88.98	1.8	0.625	0.625	6	3	10.71	28.59	76.33
1.2	0.500	0.750	5	4	18.51	19.13	91.15	1.8	0.625	0.750	5	3	11.45	20.94	68.28
1.2	0.625	0.500	4	4	14.11	73.14	154.37	1.8	0.625	0.750	6	3	11.16	19.78	57.41
1.2	0.625	0.500	5	4	12.51	71.51	151.60	1.8	0.750	0.375	7	4	10.23	100.81	199.19
1.2	0.625	0.625	4	4	12.68	38.29	93.45	2.0	0.500	0.375	8	4	16.03	94.57	199.54
1.2	0.625	0.625	5	4	11.50	37.03	92.09	2.0	0.500	0.500	5	3	14.30	71.80	166.75
1.2	0.625	0.750	4	4	11.80	21.75	67.84	2.0	0.500	0.500	6	3	14.41	55.10	134.41
1.2	0.625	0.750	5	4	11.81	20.67	67.78	2.0	0.500	0.625	5	3	16.22	35.68	109.12
1.2	0.750	0.500	4	4	10.67	69.52	141.42	2.0	0.500	0.625	6	3	16.07	26.91	91.54
1.4	0.500	0.500	5	4	18.13	76.06	175.94	2.0	0.500	0.750	5	3	16.17	19.01	86.04
1.4	0.500	0.625	5	4	17.79	37.75	115.99	2.0	0.625	0.750	6	3	15.74	14.00	74.72
1.4	0.500	0.750	5	4	18.95	19.87	94.35	2.0	0.625	0.375	8	3	10.74	90.90	183.97
1.4	0.625	0.500	5	4	12.54	73.76	156.63	2.0	0.625	0.625	5	4	11.64	90.47	182.96
1.4	0.625	0.625	5	4	11.52	38.31	95.55	2.0	0.625	0.625	5	3	10.02	36.32	90.25
1.4	0.625	0.750	5	4	12.13	21.46	70.28	2.0	0.625	0.625	6	3	10.11	27.85	73.85
1.6	0.500	0.500	5	4	17.38	75.84	175.54	2.0	0.625	0.750	5	3	10.43	20.44	65.11
1.6	0.500	0.500	6	4	17.09	57.61	141.00	2.0	0.625	0.750	6	3	10.35	15.45	55.05
1.6	0.500	0.625	5	3	18.47	37.31	117.15								
1.6	0.500	0.625	6	3	17.74	28.01	97.18								
1.6	0.500	0.750	5	3	19.15	19.58	95.03								
1.6	0.625	0.500	5	4	12.10	73.57	156.22								
1.6	0.625	0.500	6	4	11.77	54.77	124.36								
1.6	0.625	0.625	5	3	11.47	38.13	96.30								
1.6	0.625	0.625	6	3	11.19	29.12	78.14								
1.6	0.625	0.750	5	3	12.34	21.27	70.78								

PLATE AREA - 350.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.500	4	4	22.10	86.41	190.87	1.4	0.500	0.625	6	4	20.01	35.53	116.49
1.0	0.500	0.500	5	4	19.71	85.56	191.13	1.4	0.500	0.750	5	4	21.74	25.53	112.88
1.0	0.500	0.500	4	5	19.45	85.56	191.13	1.4	0.625	0.500	5	4	14.67	93.26	195.79
1.0	0.500	0.500	5	5	17.31	83.31	186.69	1.4	0.625	0.500	6	4	14.36	71.56	154.33
1.0	0.500	0.625	4	4	20.28	43.09	118.60	1.4	0.625	0.625	5	4	13.47	48.57	117.77
1.0	0.500	0.625	5	4	18.47	42.49	121.10	1.4	0.625	0.625	6	4	13.32	36.59	94.91
1.0	0.500	0.625	4	5	18.24	42.49	121.10	1.4	0.625	0.750	5	4	13.83	27.32	85.34
1.0	0.500	0.625	5	5	16.62	41.55	119.17	1.4	0.750	0.500	5	4	11.21	88.32	179.12
1.0	0.500	0.750	4	4	18.97	23.19	91.73	1.4	0.750	0.500	6	4	10.86	68.97	142.16
1.0	0.500	0.750	5	4	18.28	22.43	96.13								
1.0	0.500	0.750	4	5	17.55	22.43	96.13	1.6	0.500	0.500	6	4	19.99	72.98	173.80
1.0	0.500	0.750	5	5	18.28	22.00	95.11	1.6	0.500	0.625	5	4	19.70	47.99	140.33
1.0	0.625	0.500	4	4	15.18	84.61	175.37	1.6	0.500	0.625	6	4	19.99	35.71	117.19
1.0	0.625	0.500	5	4	13.64	82.98	173.14	1.6	0.500	0.750	5	4	21.11	25.59	111.63
1.0	0.625	0.500	4	5	13.42	82.98	173.14	1.6	0.500	0.750	6	4	21.07	18.43	97.62
1.0	0.625	0.500	5	5	12.04	80.35	167.94	1.6	0.625	0.500	5	4	14.15	92.97	195.22
1.0	0.625	0.625	4	4	13.65	43.84	102.58	1.6	0.625	0.500	6	4	13.76	71.75	154.86
1.0	0.625	0.625	5	4	12.43	42.83	102.37	1.6	0.625	0.625	5	4	12.91	48.50	117.48
1.0	0.625	0.625	4	5	12.25	42.83	102.37	1.6	0.625	0.625	6	4	12.71	36.77	95.41
1.0	0.625	0.625	5	5	11.15	41.79	100.25	1.6	0.625	0.750	5	4	13.47	27.35	84.76
1.0	0.625	0.750	4	4	12.65	24.74	71.99	1.6	0.625	0.750	6	4	13.64	20.35	71.57
1.0	0.625	0.750	5	4	11.77	23.93	73.25	1.6	0.750	0.500	5	4	10.90	87.98	178.40
1.0	0.625	0.750	4	5	11.60	23.93	73.25	1.6	0.750	0.500	6	4	10.48	69.00	142.25
1.0	0.625	0.750	5	5	11.61	23.45	72.19								
1.0	0.750	0.500	4	4	11.47	80.83	162.73	1.8	0.500	0.500	6	4	18.67	71.86	171.15
1.0	0.750	0.500	5	4	10.40	79.04	159.80	1.8	0.500	0.625	5	4	18.82	47.06	136.65
1.0	0.750	0.500	4	5	10.21	79.04	159.80	1.8	0.500	0.625	6	4	19.41	35.22	115.11
1.0	0.750	0.625	4	4	10.05	43.37	93.87	1.8	0.500	0.750	5	3	20.77	24.79	109.79
1.2	0.500	0.625	5	4	20.09	46.55	135.44	1.8	0.500	0.750	6	3	19.96	18.21	94.38
1.2	0.500	0.750	5	4	21.05	24.64	108.73	1.8	0.625	0.500	5	4	13.39	90.98	190.85
1.2	0.625	0.500	5	4	14.63	90.50	189.65	1.8	0.625	0.500	6	4	12.94	70.59	152.32
1.2	0.625	0.625	5	4	13.46	46.99	113.56	1.8	0.625	0.625	5	4	12.10	47.54	114.67
1.2	0.625	0.750	5	4	13.36	26.36	82.19	1.8	0.625	0.625	6	4	12.15	36.25	93.80
1.2	0.750	0.500	5	4	11.14	85.85	173.96	1.8	0.625	0.750	5	3	13.30	26.60	83.31
1.4	0.500	0.500	6	4	20.95	72.71	172.78	1.8	0.750	0.500	5	4	10.40	86.03	174.29
1.4	0.500	0.625	5	4	20.11	48.07	140.80	2.0	0.500	0.500	6	3	16.08	69.75	165.79

PLATE AREA - 350.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
2.0	0.500	0.500	7	3	16.71	59.21	146.57
2.0	0.500	0.625	6	3	18.35	34.24	110.89
2.0	0.500	0.625	7	3	18.83	28.46	100.91
2.0	0.500	0.750	6	3	18.65	17.89	90.31
2.0	0.500	0.750	7	3	18.82	14.43	84.22
2.0	0.625	0.500	6	3	10.77	68.68	147.99
2.0	0.625	0.500	7	3	10.49	59.09	130.16
2.0	0.625	0.625	6	3	11.51	35.25	90.72
2.0	0.625	0.625	7	3	11.92	29.81	81.00
2.0	0.625	0.750	6	3	12.14	19.60	67.05
2.0	0.625	0.750	7	3	12.40	16.26	61.24
2.0	0.750	0.375	9	4	10.54	96.29	191.03
2.0	0.750	0.375	9	5	10.22	94.96	188.52
4.0	0.500	0.375	8	3	10.03	83.98	173.84

PLATE AREA - 400.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.625	5	5	18.94	51.28	141.41	1.2	0.875	0.500	6	4	10.05	77.89	156.05
1.0	0.500	0.750	4	4	21.95	28.65	107.16	1.4	0.500	0.625	5	4	23.03	59.24	166.82
1.0	0.500	0.750	5	4	20.40	27.97	112.07	1.4	0.500	0.625	6	4	22.90	43.86	137.08
1.0	0.500	0.750	4	5	20.14	27.97	112.07	1.4	0.500	0.750	5	4	24.29	31.70	131.73
1.0	0.500	0.750	5	5	20.22	27.41	110.80	1.4	0.500	0.750	6	4	23.99	22.76	113.49
1.0	0.625	0.625	5	5	12.71	51.40	120.54	1.4	0.500	0.750	6	4	16.44	87.68	186.87
1.0	0.625	0.750	4	4	14.64	30.37	85.33	1.4	0.625	0.500	6	4	15.43	59.63	141.37
1.0	0.625	0.750	5	4	13.51	29.59	86.79	1.4	0.625	0.625	5	4	15.25	44.95	113.31
1.0	0.625	0.750	4	5	13.32	29.59	86.79	1.4	0.625	0.750	5	4	15.39	33.67	101.01
1.0	0.625	0.750	5	5	12.81	28.97	85.47	1.4	0.625	0.750	6	4	15.41	24.92	84.04
1.0	0.750	0.500	5	5	10.57	93.15	187.59	1.4	0.750	0.500	6	4	12.44	84.44	172.86
1.0	0.750	0.750	4	4	10.62	30.85	74.85	1.4	0.750	0.500	5	4	11.39	58.40	127.38
1.2	0.500	0.500	6	4	24.17	85.90	198.67	1.4	0.750	0.625	6	4	11.17	44.65	101.23
1.2	0.500	0.500	6	5	21.79	86.16	198.48	1.4	0.750	0.750	5	4	10.66	34.03	86.13
1.2	0.500	0.625	5	4	23.02	57.42	160.51	1.4	0.750	0.750	6	4	10.54	25.62	70.09
1.2	0.500	0.625	6	4	22.98	42.17	130.48	1.4	0.875	0.500	5	4	10.48	100.65	199.88
1.2	0.500	0.625	5	5	21.33	56.45	158.87	1.4	0.875	0.500	6	4	10.07	80.06	160.47
1.2	0.500	0.625	6	5	21.16	42.26	129.93	1.6	0.500	0.625	5	4	22.00	59.10	166.40
1.2	0.500	0.750	5	4	23.37	30.66	126.65	1.6	0.500	0.625	6	4	22.07	44.05	138.04
1.2	0.500	0.750	5	5	23.48	30.20	125.92	1.6	0.500	0.750	5	4	23.75	31.72	130.67
1.2	0.625	0.500	6	4	16.54	84.57	179.82	1.6	0.500	0.750	6	4	23.78	22.93	113.69
1.2	0.625	0.500	6	5	15.00	84.33	178.90	1.6	0.625	0.500	6	4	15.76	87.89	187.49
1.2	0.625	0.625	5	4	15.42	57.75	136.39	1.6	0.625	0.625	5	4	14.79	59.51	141.04
1.2	0.625	0.625	6	4	15.32	43.20	108.33	1.6	0.625	0.625	6	4	14.55	45.15	113.95
1.2	0.625	0.625	5	5	14.26	56.69	134.44	1.6	0.625	0.750	5	4	15.08	33.67	100.50
1.2	0.625	0.625	6	5	14.07	43.22	107.90	1.6	0.625	0.750	6	4	15.30	25.08	84.34
1.2	0.625	0.750	5	4	14.78	32.54	97.23	1.6	0.750	0.500	6	4	12.00	84.45	172.94
1.2	0.625	0.750	5	5	14.88	32.04	96.35	1.6	0.750	0.625	5	4	10.97	58.29	127.08
1.2	0.750	0.500	6	4	12.47	81.77	167.20	1.6	0.750	0.625	6	4	10.69	44.83	101.64
1.2	0.750	0.500	6	5	11.41	80.88	165.15	1.6	0.750	0.625	5	4	10.21	34.03	85.83
1.2	0.750	0.625	5	4	11.36	56.56	123.13	1.6	0.750	0.750	6	4	10.46	25.78	70.36
1.2	0.750	0.625	6	4	11.22	42.98	97.16	1.6	0.875	0.500	5	4	10.27	100.04	198.62
1.2	0.750	0.625	5	5	10.52	55.36	120.84	1.8	0.500	0.500	7	4	21.14	74.90	179.55
1.2	0.750	0.625	6	5	10.32	42.82	96.51	1.8	0.500	0.625	6	4	21.53	43.43	135.77
1.2	0.750	0.750	5	4	10.64	32.87	83.00	1.8	0.500	0.625	7	4	21.21	36.10	120.70
1.2	0.750	0.750	5	5	10.04	32.32	81.97								
1.2	0.875	0.500	5	4	10.37	98.15	194.86								

PLATE AREA - 400.0000

MAXIMUM STRESSES															MAXIMUM STRESSES				
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL				
1.8	0.500	0.750	6	4	22.83	22.70	110.95	4.0	0.500	0.625	9	3	10.56	18.81	63.36				
1.8	0.500	0.750	7	4	22.24	18.32	100.60	4.0	0.500	0.625	10	3	10.83	16.73	59.94				
1.8	0.625	0.500	6	4	14.82	86.45	184.41												
1.8	0.625	0.500	7	4	14.51	74.64	161.61												
1.8	0.625	0.625	6	4	13.58	44.49	112.12												
1.8	0.625	0.625	7	4	13.43	37.65	98.67												
1.8	0.625	0.750	6	4	14.71	24.77	82.62												
1.8	0.625	0.750	7	4	14.51	20.52	73.80												
1.8	0.750	0.500	6	4	11.37	82.93	169.77												
1.8	0.750	0.500	7	4	11.02	72.64	150.00												
1.8	0.750	0.625	6	4	10.04	44.14	99.96												
1.8	0.750	0.750	6	4	10.05	25.43	69.05												
1.8	0.750	0.750	7	4	10.02	21.42	61.13												
2.0	0.500	0.500	7	4	19.54	71.64	171.73												
2.0	0.500	0.625	6	4	20.63	42.39	131.86												
2.0	0.500	0.625	7	4	20.00	34.53	114.98												
2.0	0.500	0.750	6	3	21.34	22.16	105.76												
2.0	0.500	0.750	7	3	21.62	17.93	98.72												
2.0	0.625	0.500	6	4	13.81	84.15	179.40												
2.0	0.625	0.500	7	4	13.49	71.58	154.94												
2.0	0.625	0.625	6	4	12.88	43.40	109.01												
2.0	0.625	0.625	7	4	12.65	36.09	94.30												
2.0	0.625	0.750	6	3	13.80	24.12	79.40												
2.0	0.625	0.750	7	3	14.13	20.04	72.35												
2.0	0.750	0.500	6	4	10.69	80.59	164.89												
2.0	0.750	0.500	7	4	10.33	69.76	143.99												
4.0	0.500	0.375	9	3	11.15	90.59	187.78												
4.0	0.500	0.375	10	3	10.90	81.10	169.72												
4.0	0.500	0.375	11	3	10.69	85.12	164.96												
4.0	0.500	0.375	12	3	10.53	83.54	161.90												
4.0	0.500	0.375	13	3	10.39	82.21	159.31												
4.0	0.500	0.500	8	3	10.64	44.58	107.27												
4.0	0.500	0.500	9	3	10.43	38.51	95.10												
4.0	0.500	0.500	10	3	10.71	47.32	92.01												
4.0	0.500	0.625	8	3	11.01	22.17	70.94												

PLATE AREA - 450.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.625	5	5	21.27	61.70	164.74	1.4	0.500	0.625	6	5	24.11	52.90	158.13
1.0	0.500	0.750	5	5	22.01	33.24	126.91	1.4	0.500	0.750	5	4	26.64	38.36	150.97
1.0	0.625	0.625	5	5	14.28	61.67	142.00	1.4	0.500	0.750	6	4	26.37	27.64	129.36
1.0	0.625	0.750	5	5	13.91	34.90	99.32	1.4	0.625	0.625	5	4	17.39	71.45	166.27
1.0	0.750	0.625	5	5	10.58	60.13	128.99	1.4	0.625	0.625	6	4	17.19	53.88	132.67
1.2	0.500	0.625	5	4	25.96	69.06	186.79	1.4	0.625	0.625	5	5	16.35	70.51	164.76
1.2	0.500	0.625	6	4	25.92	50.78	150.90	1.4	0.625	0.625	6	5	16.05	53.95	132.42
1.2	0.500	0.625	5	5	23.94	67.85	184.75	1.4	0.625	0.750	5	4	16.83	40.48	117.31
1.2	0.500	0.625	6	5	23.73	50.92	150.36	1.4	0.750	0.625	6	4	16.88	29.99	97.04
1.2	0.500	0.750	5	4	25.51	37.15	145.00	1.4	0.750	0.625	5	4	12.83	69.88	150.75
1.2	0.500	0.750	6	4	25.27	26.57	122.89	1.4	0.750	0.625	6	4	12.59	53.44	119.40
1.2	0.500	0.750	5	5	25.65	36.57	144.10	1.4	0.750	0.625	5	5	12.09	68.83	148.86
1.2	0.500	0.750	6	5	24.70	26.61	122.14	1.4	0.750	0.750	5	4	12.01	40.80	100.97
1.2	0.625	0.625	5	4	17.39	69.25	160.51	1.4	0.750	0.750	6	4	11.87	30.72	81.75
1.2	0.625	0.625	6	4	17.28	51.81	126.88	1.4	0.875	0.500	6	4	11.34	95.67	191.12
1.2	0.625	0.625	5	5	16.02	67.94	158.12	1.4	0.875	0.500	6	5	10.66	94.48	188.64
1.2	0.625	0.625	6	5	15.79	51.87	126.47	1.4	0.875	0.625	5	4	10.14	67.28	139.40
1.2	0.625	0.750	5	4	16.61	39.16	112.89	1.6	0.500	0.625	6	4	24.57	53.00	159.70
1.2	0.625	0.750	6	4	16.58	28.79	92.45	1.6	0.500	0.625	7	4	24.46	45.26	144.63
1.2	0.625	0.750	5	5	16.22	38.53	111.81	1.6	0.500	0.750	6	4	26.28	27.80	129.90
1.2	0.625	0.750	6	5	15.77	28.82	91.98	1.6	0.500	0.750	7	4	26.11	23.11	120.22
1.2	0.750	0.500	6	4	14.06	97.78	198.84	1.6	0.625	0.500	7	4	17.43	92.42	197.81
1.2	0.750	0.500	6	5	12.82	96.75	196.51	1.6	0.625	0.625	6	4	16.40	54.11	133.45
1.2	0.750	0.625	5	4	12.80	67.73	145.81	1.6	0.625	0.625	7	4	16.23	46.83	119.51
1.2	0.750	0.625	6	4	12.65	51.46	114.65	1.6	0.625	0.750	6	4	16.84	30.17	97.52
1.2	0.750	0.625	5	5	11.82	66.27	143.02	1.6	0.625	0.750	7	4	16.87	25.63	88.72
1.2	0.750	0.625	6	5	11.58	51.30	113.96	1.6	0.750	0.500	7	4	13.14	89.68	184.02
1.2	0.750	0.750	5	4	11.99	39.44	97.33	1.6	0.750	0.625	6	4	12.05	53.63	119.89
1.2	0.750	0.750	6	5	11.19	29.49	78.13	1.6	0.750	0.625	7	4	11.85	46.89	107.07
1.2	0.750	0.750	6	5	11.05	38.76	96.07	1.6	0.750	0.750	6	4	11.49	30.89	82.14
1.2	0.875	0.500	5	4	11.33	29.47	77.71	1.6	0.750	0.750	7	4	11.60	26.59	73.96
1.2	0.875	0.500	6	5	10.43	93.11	185.90	1.6	0.875	0.500	6	4	11.01	95.37	190.53
1.2	0.875	0.625	5	4	10.09	91.40	182.35	1.6	0.875	0.500	7	4	10.62	85.61	171.86
1.2	0.875	0.625	5	4	10.09	65.27	135.10	1.8	0.500	0.625	6	4	23.49	52.22	157.22
1.4	0.500	0.625	5	4	25.95	71.18	194.05	1.8	0.500	0.625	7	4	23.15	43.50	139.38
1.4	0.500	0.625	6	4	25.80	52.79	158.51	1.8	0.500	0.750	6	4	23.37	27.48	127.11
1.4	0.500	0.625	5	5	24.39	70.31	192.96								

PLATE AREA - 450.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.8	0.500	0.750	7	4	24.76	22.26	115.10	4.0	0.500	0.375	14	3	11.55	97.24	188.45
1.8	0.625	0.500	7	4	16.35	89.29	191.26	4.0	0.500	0.375	10	4	12.91	95.63	198.63
1.8	0.625	0.625	6	4	15.31	53.30	131.36	4.0	0.500	0.375	11	4	12.67	85.57	178.95
1.8	0.625	0.625	7	4	15.14	45.16	115.37	4.0	0.500	0.375	12	4	12.47	78.77	166.17
1.8	0.625	0.750	6	4	16.28	29.77	95.69	4.0	0.500	0.375	13	4	12.31	71.93	152.81
1.8	0.625	0.750	7	4	16.06	24.72	85.29	4.0	0.500	0.375	14	4	12.16	66.97	143.48
1.8	0.750	0.500	7	4	12.41	86.82	178.20	4.0	0.500	0.500	8	3	11.75	53.24	126.06
1.8	0.750	0.625	6	4	11.31	52.79	117.93	4.0	0.500	0.500	9	3	11.52	57.85	112.47
1.8	0.750	0.625	7	4	11.10	45.36	103.57	4.0	0.500	0.500	10	3	11.83	56.98	110.76
1.8	0.750	0.750	6	4	11.06	30.47	80.69	4.0	0.500	0.500	11	3	11.69	56.28	109.39
1.8	0.750	0.750	7	4	10.52	25.71	71.31	4.0	0.500	0.625	8	3	12.50	26.50	82.75
1.8	0.875	0.500	6	4	10.52	93.39	186.53	4.0	0.500	0.625	9	3	12.01	22.47	73.77
1.8	0.875	0.500	7	4	10.10	82.93	166.47	4.0	0.500	0.625	10	3	12.32	20.01	69.73
2.0	0.500	0.500	8	4	21.80	73.70	179.33	4.0	0.500	0.625	11	3	12.00	17.57	64.22
2.0	0.500	0.625	6	4	22.59	50.95	152.85	4.0	0.500	0.750	8	3	11.47	14.36	63.68
2.0	0.500	0.625	7	4	21.90	41.57	132.91	4.0	0.500	0.750	9	3	10.79	12.00	57.10
2.0	0.500	0.625	8	4	22.43	35.45	122.35	4.0	0.500	0.750	10	3	11.02	10.58	54.91
2.0	0.500	0.750	6	4	24.06	26.91	122.67	4.0	0.500	0.750	11	3	10.56	9.17	50.80
2.0	0.500	0.750	7	4	23.05	21.36	108.78								
2.0	0.625	0.500	7	4	15.21	85.60	183.35								
2.0	0.625	0.500	8	4	14.93	73.52	160.54								
2.0	0.625	0.625	6	4	14.16	51.97	127.79								
2.0	0.625	0.625	7	4	13.98	43.26	110.32								
2.0	0.625	0.625	8	4	14.20	37.04	99.02								
2.0	0.625	0.750	6	4	15.46	29.09	92.69								
2.0	0.625	0.750	7	4	15.00	23.70	81.07								
2.0	0.750	0.500	6	4	12.05	96.27	195.97								
2.0	0.750	0.500	7	4	11.64	83.36	171.03								
2.0	0.750	0.500	8	4	11.32	71.77	148.99								
2.0	0.750	0.625	6	4	10.53	51.44	114.71								
2.0	0.750	0.625	7	4	10.30	43.53	99.25								
2.0	0.750	0.625	8	4	10.13	37.32	87.70								
2.0	0.750	0.750	6	4	10.53	29.75	78.31								
2.0	0.750	0.750	7	4	10.34	24.67	68.04								
4.0	0.500	0.375	11	3	12.03	102.03	197.75								
4.0	0.500	0.375	12	3	11.84	100.17	194.15								
4.0	0.500	0.375	13	3	11.68	98.60	191.09								

PLATE AREA - 500.0000

MAXIMUM STRESSES															
MAXIMUM STRESSES										MAXIMUM STRESSES					
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.625	5	5	23.59	72.77	189.13	1.4	0.500	0.625	6	4	28.71	62.28	180.77
1.0	0.500	0.625	6	5	23.39	72.48	188.29	1.4	0.500	0.625	7	4	28.58	55.00	167.41
1.0	0.500	0.625	5	6	23.29	72.48	188.29	1.4	0.500	0.625	6	5	26.73	62.44	180.40
1.0	0.500	0.625	6	6	23.10	54.45	151.53	1.4	0.500	0.625	7	5	26.76	50.76	159.92
1.0	0.500	0.750	5	5	23.68	39.47	143.45	1.4	0.500	0.750	6	4	28.58	32.86	145.45
1.0	0.500	0.750	6	5	23.23	39.35	142.94	1.4	0.500	0.750	7	4	28.87	28.37	137.51
1.0	0.500	0.750	5	6	23.58	39.35	142.94	1.4	0.500	0.750	6	5	28.34	32.91	144.85
1.0	0.500	0.750	6	6	23.04	28.76	119.50	1.4	0.500	0.750	7	5	29.16	26.01	133.67
1.0	0.625	0.625	5	5	15.84	72.56	164.56	1.4	0.625	0.625	6	4	19.13	63.36	152.96
1.0	0.625	0.625	6	5	15.65	72.06	163.34	1.4	0.625	0.625	7	4	18.99	56.36	139.93
1.0	0.625	0.625	5	6	15.54	72.06	163.34	1.4	0.625	0.625	6	5	17.80	63.46	152.73
1.0	0.625	0.625	6	6	15.36	55.04	129.73	1.4	0.625	0.625	7	5	17.73	53.01	133.87
1.0	0.625	0.750	5	5	15.30	41.20	113.75	1.4	0.625	0.750	6	4	18.39	35.39	110.45
1.0	0.625	0.750	6	5	15.20	41.01	113.16	1.4	0.625	0.750	7	4	18.52	31.03	102.59
1.0	0.625	0.750	5	6	15.11	41.01	113.16	1.4	0.625	0.750	6	5	18.07	35.44	110.11
1.0	0.625	0.750	6	6	15.00	30.72	92.05	1.4	0.625	0.750	7	5	18.77	29.02	99.14
1.0	0.750	0.625	5	5	11.74	70.68	150.24	1.4	0.750	0.625	6	4	14.01	62.75	138.51
1.0	0.750	0.625	6	5	11.56	69.90	148.51	1.4	0.750	0.625	7	4	13.81	56.10	126.04
1.0	0.750	0.625	5	6	11.45	69.90	148.51	1.4	0.750	0.625	6	5	13.07	62.68	138.08
1.0	0.750	0.625	6	6	11.27	54.18	117.92	1.4	0.750	0.625	7	5	12.94	53.52	121.28
1.0	0.750	0.750	5	5	11.06	41.28	99.16	1.4	0.750	0.750	6	4	13.21	36.14	93.91
1.0	0.750	0.750	6	5	10.95	40.99	98.39	1.4	0.750	0.750	7	4	13.09	31.94	86.22
1.0	0.750	0.750	5	6	10.86	40.99	98.39	1.4	0.750	0.750	6	5	12.44	36.15	93.63
1.0	0.750	0.750	6	6	10.75	31.20	78.97	1.4	0.750	0.750	7	5	12.90	30.29	83.31
1.0	0.875	0.500	5	5	10.17	96.07	190.85	1.4	0.875	0.500	7	5	11.51	98.81	197.95
1.2	0.500	0.625	6	5	26.30	60.14	171.63	1.4	0.875	0.625	6	4	10.98	61.22	128.82
1.2	0.500	0.750	5	5	27.67	43.37	162.70	1.4	0.875	0.625	7	4	10.76	54.99	117.07
1.2	0.500	0.750	5	5	26.66	31.58	137.24	1.4	0.875	0.625	6	5	10.30	60.91	127.98
1.2	0.625	0.625	5	5	17.77	79.87	182.99	1.4	0.875	0.625	7	5	10.12	52.97	113.28
1.2	0.625	0.625	6	5	17.50	61.05	145.86	1.4	0.875	0.750	6	4	10.13	36.06	84.55
1.2	0.625	0.750	5	5	17.47	45.43	127.87	1.4	0.875	0.750	7	4	10.00	32.05	77.13
1.2	0.625	0.750	5	5	17.08	34.05	104.72	1.4	1.000	0.500	7	4	10.30	96.05	190.04
1.2	0.750	0.625	5	5	13.11	77.83	156.39	1.6	0.500	0.625	6	4	27.34	62.51	182.17
1.2	0.750	0.625	6	5	12.85	60.30	132.34	1.6	0.500	0.625	7	4	27.21	53.48	164.60
1.2	0.750	0.750	5	5	12.41	45.60	110.82	1.6	0.500	0.750	6	4	28.60	33.02	146.30
1.2	0.750	0.750	6	5	12.25	34.70	89.33	1.6	0.500	0.750	7	4	28.45	27.57	135.16
1.2	0.875	0.625	5	5	10.37	74.68	153.91	1.6	0.625	0.625	6	4	18.25	63.61	153.86
1.2	0.875	0.625	6	5	10.11	58.64	122.97	1.6	0.625	0.625	7	4	18.06	55.12	137.58

PLATE AREA - 500.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	0.625	0.750	6	4	18.28	35.58	111.10	2.0	0.625	0.625	6	4	15.76	61.06	147.43
1.6	0.625	0.750	7	4	18.31	30.30	100.88	2.0	0.625	0.625	7	4	15.56	50.86	127.04
1.6	0.750	0.625	6	4	13.41	62.95	139.08	2.0	0.625	0.625	8	4	15.40	43.59	113.74
1.6	0.750	0.625	7	4	13.19	55.10	124.10	2.0	0.625	0.750	6	4	16.91	34.27	105.88
1.6	0.750	0.750	6	4	12.60	36.33	94.40	2.0	0.625	0.750	7	4	16.42	27.97	92.41
1.6	0.750	0.750	7	4	12.57	31.32	84.87	2.0	0.625	0.750	8	4	16.79	23.81	85.24
1.6	0.875	0.500	7	5	11.26	97.99	196.34	2.0	0.750	0.500	7	4	12.95	97.76	199.57
1.6	0.875	0.500	6	4	10.57	61.32	129.07	2.0	0.750	0.500	8	4	12.60	84.18	173.71
1.6	0.875	0.625	7	4	10.31	54.15	115.42	2.0	0.750	0.625	6	4	11.72	60.35	133.11
1.6	1.000	0.500	7	4	10.01	94.48	186.95	2.0	0.750	0.625	7	4	11.47	51.10	115.03
1.8	0.500	0.625	6	4	25.44	61.57	179.44	2.0	0.750	0.625	8	4	11.28	43.83	101.46
1.8	0.500	0.625	7	4	25.31	51.37	158.68	2.0	0.750	0.750	6	4	11.50	34.95	90.16
1.8	0.500	0.625	8	4	25.37	43.35	144.15	2.0	0.750	0.750	7	4	11.30	29.02	78.19
1.8	0.500	0.750	6	4	27.74	32.60	143.45	2.0	0.750	0.750	8	4	11.59	24.81	70.61
1.8	0.500	0.750	7	4	27.11	26.51	129.67	2.0	0.875	0.500	7	4	10.62	93.37	186.77
1.8	0.625	0.500	8	4	17.91	89.36	193.15	2.0	0.875	0.500	8	4	10.25	80.82	162.80
1.8	0.625	0.625	6	4	17.04	62.64	151.49	4.0	0.500	0.375	12	4	13.88	92.30	193.34
1.8	0.625	0.625	7	4	16.85	53.13	132.82	4.0	0.500	0.375	13	4	13.69	84.29	177.69
1.8	0.625	0.625	8	4	16.70	45.09	117.87	4.0	0.500	0.375	14	4	13.53	78.49	166.75
1.8	0.625	0.750	6	4	17.74	35.09	109.15	4.0	0.500	0.375	15	4	13.40	84.08	163.04
1.8	0.625	0.750	7	4	17.51	29.20	97.09	4.0	0.500	0.500	9	3	12.54	68.22	132.61
1.8	0.750	0.500	8	4	13.48	87.21	180.01	4.0	0.500	0.500	10	3	12.88	67.22	130.65
1.8	0.750	0.625	6	4	12.59	61.96	136.82	4.0	0.500	0.500	11	3	12.73	66.41	129.08
1.8	0.750	0.625	7	4	12.35	53.27	120.03	4.0	0.500	0.625	9	3	13.37	26.37	84.42
1.8	0.750	0.625	8	4	12.18	45.34	105.10	4.0	0.500	0.625	10	3	13.73	23.51	79.71
1.8	0.750	0.750	6	4	12.08	35.81	92.81	4.0	0.500	0.625	11	3	13.38	38.62	75.69
1.8	0.750	0.750	7	4	12.03	30.26	81.88	4.0	0.500	0.750	9	3	12.42	14.05	63.68
1.8	0.875	0.500	7	4	11.24	97.25	174.61	4.0	0.500	0.750	10	3	12.70	12.39	63.21
1.8	0.875	0.500	8	4	10.88	83.83	168.91	4.0	0.500	0.750	11	3	12.19	10.73	58.48
2.0	0.500	0.625	6	4	24.42	60.05	174.59	4.0	0.625	0.375	11	3	10.42	98.27	197.19
2.0	0.500	0.625	7	4	23.68	49.07	151.41	4.0	0.625	0.375	12	3	10.17	89.98	181.29
2.0	0.500	0.625	8	4	24.27	41.90	138.97	4.0	0.625	0.375	11	4	10.74	96.67	193.89
2.0	0.500	0.750	6	4	26.43	31.89	138.74	4.0	0.625	0.375	12	4	10.48	89.01	179.28
2.0	0.500	0.750	7	4	25.36	25.38	122.84	4.0	0.625	0.375	13	4	10.26	82.16	166.05
2.0	0.500	0.750	8	4	25.84	21.28	116.34	4.0	0.625	0.375	14	4	10.07	76.51	155.27
2.0	0.625	0.500	8	4	16.62	86.30	186.51								

PLATE AREA - 550.0000

MAXIMUM STRESSES															MAXIMUM STRESSES														
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL														
1.0	0.500	0.625	6	6	25.35	63.29	171.30	1.4	0.500	0.625	7	4	31.47	63.98	188.47														
1.0	0.500	0.750	5	5	25.55	46.06	160.44	1.4	0.500	0.625	7	5	29.40	58.92	179.46														
1.0	0.500	0.750	6	5	25.47	45.93	159.89	1.4	0.500	0.750	6	4	30.90	38.41	161.80														
1.0	0.500	0.750	5	6	25.34	45.93	159.89	1.4	0.500	0.750	7	4	30.98	33.29	152.73														
1.0	0.500	0.750	6	6	25.26	33.68	133.07	1.4	0.500	0.750	6	5	30.39	38.48	161.15														
1.0	0.625	0.625	5	5	17.41	84.04	188.20	1.4	0.500	0.750	7	5	31.30	30.44	148.00														
1.0	0.625	0.625	6	5	17.19	83.46	186.81	1.4	0.625	0.625	6	4	21.07	73.35	174.13														
1.0	0.625	0.625	5	6	17.07	83.46	186.81	1.4	0.625	0.625	7	4	20.87	65.34	159.15														
1.0	0.625	0.625	6	6	16.87	63.80	148.03	1.4	0.625	0.625	6	5	19.55	73.49	173.95														
1.0	0.625	0.750	5	5	16.80	47.85	128.74	1.4	0.625	0.625	7	5	19.49	61.35	151.88														
1.0	0.625	0.750	6	5	16.68	47.64	128.09	1.4	0.625	0.750	6	4	20.25	41.11	124.29														
1.0	0.625	0.750	5	6	16.58	47.64	128.09	1.4	0.625	0.750	7	4	20.15	36.13	115.27														
1.0	0.625	0.750	6	6	16.46	35.74	103.78	1.4	0.625	0.750	6	5	19.33	41.17	123.94														
1.0	0.750	0.625	5	5	12.90	81.80	172.56	1.4	0.625	0.750	7	5	20.10	33.70	111.06														
1.0	0.750	0.625	6	5	12.70	80.90	170.58	1.4	0.750	0.625	6	4	15.43	72.55	158.54														
1.0	0.750	0.625	5	6	12.58	80.90	170.58	1.4	0.750	0.625	7	4	15.21	64.94	144.20														
1.0	0.750	0.625	6	6	12.38	62.74	135.24	1.4	0.750	0.625	6	5	14.36	72.50	158.10														
1.0	0.750	0.750	5	5	12.15	47.85	113.08	1.4	0.750	0.625	7	5	14.23	61.87	138.52														
1.0	0.750	0.750	6	5	12.02	47.52	112.21	1.4	0.750	0.750	6	4	14.55	41.86	106.55														
1.0	0.750	0.750	5	6	11.93	47.52	112.21	1.4	0.750	0.750	7	4	14.42	37.07	97.73														
1.0	0.750	0.750	6	6	11.80	36.20	89.79	1.4	0.750	0.750	6	5	13.66	41.89	106.27														
1.0	0.875	0.625	5	5	10.25	78.53	160.53	1.4	0.750	0.750	7	5	13.80	35.07	94.18														
1.0	0.875	0.625	6	5	10.06	77.27	157.89	1.4	0.875	0.625	6	4	12.10	70.75	147.90														
1.2	0.500	0.625	6	5	28.86	69.87	193.71	1.4	0.875	0.625	7	4	11.85	63.60	134.39														
1.2	0.500	0.750	5	5	29.57	50.57	181.75	1.4	0.875	0.625	6	5	11.32	70.41	146.98														
1.2	0.500	0.750	6	5	28.72	37.07	152.61	1.4	0.875	0.625	7	5	11.13	61.20	129.88														
1.2	0.625	0.625	6	5	19.22	70.73	166.33	1.4	0.875	0.750	6	4	11.16	41.71	96.45														
1.2	0.625	0.750	5	5	18.91	52.72	144.52	1.4	0.875	0.750	7	4	11.02	37.13	87.94														
1.2	0.625	0.750	6	5	18.73	39.58	117.89	1.4	0.875	0.750	6	5	10.50	41.65	96.08														
1.2	0.750	0.625	5	5	14.41	90.00	190.91	1.4	0.875	0.750	7	5	10.39	35.51	85.01														
1.2	0.750	0.625	6	5	14.12	69.77	151.61	1.6	0.500	0.625	7	4	29.97	62.18	185.24														
1.2	0.750	0.750	5	5	13.63	52.80	126.20	1.6	0.500	0.625	7	5	28.32	58.44	178.89														
1.2	0.750	0.750	6	5	13.44	40.23	101.42	1.6	0.500	0.750	6	4	30.79	38.57	162.94														
1.2	0.875	0.625	5	5	11.40	86.33	177.04	1.6	0.500	0.750	7	4	30.64	32.31	150.25														
1.2	0.875	0.625	6	5	11.11	67.81	141.29	1.6	0.500	0.750	6	5	30.60	38.64	162.52														
1.2	0.875	0.750	5	5	10.51	51.86	114.96	1.6	0.500	0.750	7	5	30.99	30.19	147.08														
1.2	0.875	0.750	6	5	10.33	40.01	91.92	1.6	0.625	0.625	6	4	20.10	73.62	175.16														

PLATE AREA - 550.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	0.625	0.625	7	4	19.90	63.86	156.41	1.8	0.625	0.750	8	4	17.15	28.60	99.53
1.6	0.625	0.625	6	5	18.90	73.79	175.14	1.8	0.750	0.625	6	4	13.87	71.61	156.50
1.6	0.625	0.625	7	5	18.81	60.86	151.13	1.8	0.750	0.625	7	4	13.61	61.60	137.24
1.6	0.625	0.750	6	4	19.62	41.30	125.10	1.8	0.750	0.625	8	4	13.41	52.45	119.97
1.6	0.625	0.750	7	4	19.66	35.25	113.37	1.8	0.750	0.750	6	4	13.00	41.45	105.39
1.6	0.625	0.750	6	5	19.48	41.38	124.91	1.8	0.750	0.750	7	4	12.95	35.06	92.83
1.6	0.625	0.750	7	5	19.94	33.43	110.42	1.8	0.750	0.750	8	4	13.19	29.71	82.95
1.6	0.750	0.625	6	4	14.78	72.77	159.17	1.8	0.875	0.500	8	4	11.99	96.82	194.48
1.6	0.750	0.625	7	4	14.53	63.75	141.92	1.8	0.875	0.625	6	4	11.00	69.64	145.58
1.6	0.750	0.625	6	5	13.94	72.81	158.99	1.8	0.875	0.625	7	4	10.70	60.63	128.26
1.6	0.750	0.625	7	5	13.77	61.41	137.69	1.8	0.875	0.625	8	4	10.47	51.79	111.90
1.6	0.750	0.750	6	4	13.88	42.06	107.14	1.8	0.875	0.750	6	4	10.02	41.26	95.27
1.6	0.750	0.750	7	4	13.74	36.32	96.19	1.8	1.000	0.500	8	4	10.16	91.78	182.06
1.6	0.750	0.750	6	5	13.24	42.11	107.02	2.0	0.500	0.625	7	4	25.66	56.99	170.50
1.6	0.750	0.750	7	5	13.70	34.81	93.52	2.0	0.500	0.625	8	4	25.99	48.73	156.06
1.6	0.875	0.500	8	4	12.65	99.56	199.99	2.0	0.500	0.750	7	4	27.52	29.68	137.01
1.6	0.875	0.500	3	5	12.05	98.22	197.34	2.0	0.500	0.750	8	4	28.07	24.94	129.50
1.6	0.875	0.625	5	4	11.64	70.85	148.17	2.0	0.625	0.625	7	4	17.15	58.88	144.44
1.6	0.875	0.625	7	4	11.36	62.61	132.44	2.0	0.625	0.625	8	4	16.97	50.49	129.05
1.6	0.875	0.625	6	5	11.04	70.68	147.65	2.0	0.625	0.750	7	4	17.76	32.48	104.04
1.6	0.875	0.625	7	5	10.80	60.77	129.05	2.0	0.625	0.750	8	4	18.17	27.68	95.73
1.6	0.875	0.750	6	4	10.68	41.89	96.87	2.0	0.750	0.500	8	4	13.88	97.24	199.66
1.6	0.875	0.750	7	4	10.52	36.51	86.65	2.0	0.750	0.625	7	4	12.64	59.08	131.53
1.6	0.875	0.750	6	5	10.17	41.89	96.68	2.0	0.750	0.625	8	4	12.43	50.69	115.83
1.6	0.875	0.750	7	5	10.04	35.27	84.49	2.0	0.750	0.750	7	4	12.20	33.61	88.70
1.6	1.000	0.500	8	4	10.65	94.56	187.59	2.0	0.750	0.750	8	4	12.52	28.75	79.92
1.6	1.000	0.500	8	5	10.20	93.21	184.93	2.0	0.875	0.500	8	4	11.28	93.33	187.42
1.6	0.500	0.625	7	4	27.89	59.69	178.60	2.0	1.000	0.500	7	4	10.04	101.27	199.94
1.8	0.500	0.625	8	4	27.76	50.43	161.77	4.0	0.500	0.375	14	4	14.91	90.60	191.13
1.8	0.500	0.750	6	4	29.96	38.05	160.01	4.0	0.500	0.375	15	4	14.76	97.32	188.72
1.8	0.500	0.750	7	4	29.31	31.03	144.37	4.0	0.500	0.375	16	4	14.62	96.34	186.81
1.8	0.500	0.750	8	4	29.64	25.72	135.08	4.0	0.500	0.500	9	3	13.51	79.15	153.82
1.8	0.625	0.625	6	4	18.77	72.49	172.49	4.0	0.500	0.500	10	3	13.87	78.01	151.60
1.8	0.625	0.625	7	4	18.57	61.53	150.99	4.0	0.500	0.500	11	3	13.71	77.10	149.82
1.8	0.625	0.625	8	4	18.40	52.25	133.68	4.0	0.500	0.500	12	3	13.94	76.34	148.35
1.8	0.625	0.750	6	4	19.11	40.72	123.01	4.0	0.500	0.625	9	3	14.66	30.49	95.32
1.8	0.625	0.750	7	4	18.86	33.94	109.19	4.0	0.500	0.625	9	3	14.66	30.49	95.32

PLATE AREA - 550.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
4.0	0.500	0.625	10	3	15.06	27.21	89.91
4.0	0.500	0.625	11	3	14.69	45.02	88.17
4.0	0.500	0.625	12	3	14.93	44.72	87.58
4.0	0.500	0.750	9	3	13.99	16.22	74.31
4.0	0.500	0.750	10	3	14.32	14.33	71.54
4.0	0.500	0.750	11	3	13.77	12.41	66.18
4.0	0.500	0.750	12	3	13.94	11.16	64.20
4.0	0.625	0.375	13	3	10.95	96.36	194.22
4.0	0.625	0.375	14	3	10.75	97.86	189.57
4.0	0.625	0.375	15	3	10.58	96.08	186.11
4.0	0.625	0.375	16	3	10.43	94.49	183.04
4.0	0.625	0.375	13	4	11.30	94.79	190.96
4.0	0.625	0.375	14	4	11.09	88.28	178.51
4.0	0.625	0.375	15	4	10.91	82.43	167.21
4.0	0.625	0.375	16	4	10.76	77.43	157.65

PLATE AREA - 600.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.625	6	6	27.61	72.59	191.81	1.2	0.750	0.625	6	5	15.38	79.72	171.73
1.0	0.500	0.750	5	5	27.81	53.01	177.88	1.2	0.750	0.625	7	5	15.28	78.90	163.87
1.0	0.500	0.750	6	5	27.70	52.86	177.30	1.2	0.750	0.625	6	6	15.11	79.11	170.36
1.0	0.500	0.750	5	6	27.58	52.86	177.30	1.2	0.750	0.625	7	6	15.03	68.20	150.44
1.0	0.500	0.750	6	6	27.47	38.87	146.93	1.2	0.750	0.750	6	5	14.64	46.04	113.98
1.0	0.625	0.625	6	6	18.37	73.01	167.11	1.2	0.750	0.750	7	5	14.60	46.46	106.14
1.0	0.625	0.750	5	5	18.29	54.84	144.28	1.2	0.750	0.750	6	6	14.49	45.83	113.38
1.0	0.625	0.750	6	5	18.15	54.60	143.56	1.2	0.750	0.750	7	6	14.43	38.73	101.09
1.0	0.625	0.750	5	6	18.05	54.60	143.56	1.2	0.875	0.625	6	5	12.11	77.43	160.45
1.0	0.625	0.750	6	6	17.91	41.03	115.91	1.2	0.875	0.625	7	5	11.96	74.98	151.76
1.0	0.750	0.625	5	5	14.06	93.45	195.88	1.2	0.875	0.625	6	6	11.85	76.61	158.67
1.0	0.750	0.625	6	5	13.84	92.43	193.65	1.2	0.875	0.625	7	6	11.71	67.23	141.35
1.0	0.750	0.625	5	6	13.71	92.43	193.65	1.2	0.875	0.750	6	5	11.25	45.73	103.81
1.0	0.750	0.625	6	6	13.49	71.71	153.33	1.2	0.875	0.750	7	5	11.17	45.22	97.35
1.0	0.750	0.750	5	5	13.24	54.75	127.57	1.2	0.875	0.750	6	6	11.06	45.43	103.05
1.0	0.750	0.750	6	5	13.09	54.37	126.60	1.2	0.875	0.750	7	6	11.00	39.08	91.79
1.0	0.750	0.750	5	6	12.99	54.37	126.60	1.2	1.000	0.625	6	5	10.02	74.43	150.81
1.0	0.750	0.750	6	6	12.85	41.46	101.04	1.4	0.500	0.625	7	5	32.04	67.49	199.60
1.0	0.875	0.625	5	5	11.17	89.67	182.60	1.4	0.500	0.750	6	5	32.32	44.36	177.74
1.0	0.875	0.625	6	5	10.96	88.25	179.60	1.4	0.500	0.750	7	5	33.32	35.11	162.47
1.0	0.875	0.625	5	6	10.83	88.25	179.60	1.4	0.625	0.625	6	5	21.29	84.02	196.04
1.0	0.875	0.625	6	6	10.62	69.48	143.29	1.4	0.625	0.625	7	5	21.24	70.08	170.59
1.0	0.875	0.750	5	5	10.25	53.71	117.13	1.4	0.625	0.750	6	5	20.72	47.20	138.20
1.0	0.875	0.750	6	5	10.11	53.15	115.85	1.4	0.625	0.750	7	5	21.35	38.61	123.27
1.0	0.875	0.750	5	6	10.01	53.15	115.85	1.4	0.750	0.625	6	5	15.65	82.80	179.00
1.2	0.500	0.625	7	6	31.29	65.59	191.35	1.4	0.750	0.625	7	5	15.51	70.62	156.47
1.2	0.500	0.750	6	5	31.24	42.76	168.30	1.4	0.750	0.750	6	5	14.88	47.91	119.39
1.2	0.500	0.750	7	5	31.61	34.20	155.44	1.4	0.750	0.750	7	5	14.81	40.08	105.42
1.2	0.500	0.750	6	6	31.05	42.67	167.86	1.4	0.875	0.625	6	5	12.34	80.36	166.85
1.2	0.500	0.750	7	6	31.53	34.12	155.05	1.4	0.875	0.625	7	5	12.13	69.83	147.22
1.2	0.625	0.625	6	5	20.93	80.90	187.56	1.4	0.875	0.750	6	5	11.44	47.59	108.46
1.2	0.625	0.625	7	5	20.92	81.88	178.54	1.4	0.875	0.750	7	5	11.33	40.55	95.70
1.2	0.625	0.625	6	6	20.66	80.48	186.50	1.4	1.000	0.625	6	5	10.22	77.12	156.43
1.2	0.625	0.625	7	6	20.67	67.91	164.02	1.6	0.500	0.625	8	4	32.62	59.47	184.29
1.2	0.625	0.750	6	5	20.39	45.40	131.48	1.6	0.500	0.625	7	5	30.87	66.94	199.03
1.2	0.625	0.750	7	5	20.40	46.89	119.56	1.6	0.500	0.625	8	5	30.76	58.15	181.73
1.2	0.625	0.750	6	6	20.20	45.26	130.99	1.6	0.500	0.750	6	4	32.85	44.44	179.84
1.2	0.625	0.750	7	6	20.24	37.40	118.00								

PLATE AREA - 600.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	0.500	0.750	7	4	32.70	37.33	165.52	1.6	0.875	0.750	6	5	11.09	47.83	109.14
1.6	0.500	0.750	8	4	32.84	30.52	152.77	1.6	0.875	0.750	7	5	10.95	40.27	95.13
1.6	0.500	0.750	6	5	32.64	44.52	179.40	1.6	0.875	0.750	8	5	10.82	34.66	84.32
1.6	0.500	0.750	7	5	33.09	34.81	161.69	1.6	1.000	0.625	6	4	10.53	77.77	197.91
1.6	0.500	0.750	8	5	32.86	29.77	151.35	1.6	1.000	0.625	7	4	10.21	69.33	141.80
1.6	0.625	0.625	6	4	21.96	84.13	197.31	1.6	1.000	0.625	6	5	10.02	77.32	156.89
1.6	0.625	0.625	7	4	21.74	73.03	175.98								
1.6	0.625	0.625	8	4	21.57	61.35	153.85	1.8	0.500	0.625	7	4	30.47	68.43	199.13
1.6	0.625	0.625	6	5	20.59	84.34	197.35	1.8	0.500	0.625	8	4	30.33	57.88	179.89
1.6	0.625	0.625	7	5	20.51	69.53	169.75	1.8	0.500	0.625	7	5	28.94	65.08	193.64
1.6	0.625	0.625	8	5	20.36	60.23	151.68	1.8	0.500	0.625	8	5	28.82	56.91	178.12
1.6	0.625	0.750	6	4	21.07	47.32	139.50	1.8	0.500	0.750	7	4	31.38	35.81	159.22
1.6	0.625	0.750	7	4	20.95	40.45	126.20	1.8	0.500	0.750	8	4	31.76	29.76	148.64
1.6	0.625	0.750	8	4	21.12	33.67	113.49	1.8	0.500	0.750	7	5	31.77	33.88	156.55
1.6	0.625	0.750	6	5	20.74	47.41	139.32	1.8	0.500	0.750	8	5	31.82	29.20	147.71
1.6	0.625	0.750	7	5	21.24	38.30	122.55	1.8	0.625	0.625	7	4	20.28	70.34	169.86
1.6	0.625	0.750	8	5	21.14	33.00	112.21	1.8	0.625	0.625	8	4	20.10	59.76	150.08
1.6	0.750	0.625	6	4	16.14	83.07	180.13	1.8	0.625	0.625	7	5	19.29	67.63	165.16
1.6	0.750	0.625	7	4	15.87	72.81	160.50	1.8	0.625	0.625	8	5	19.12	58.94	148.55
1.6	0.750	0.625	8	4	15.67	61.46	138.91	1.8	0.625	0.750	7	4	20.14	38.92	121.61
1.6	0.750	0.625	6	5	15.20	83.13	179.98	1.8	0.625	0.750	8	4	20.46	32.83	110.56
1.6	0.750	0.625	7	5	15.01	70.08	155.53	1.8	0.625	0.750	7	5	20.44	37.26	119.01
1.6	0.750	0.625	8	5	14.83	60.53	137.07	1.8	0.625	0.750	8	5	20.51	32.33	109.69
1.6	0.750	0.750	6	4	15.17	48.07	120.35	1.8	0.750	0.625	7	4	14.87	70.34	155.18
1.6	0.750	0.750	7	4	15.01	41.56	107.90	1.8	0.750	0.625	8	4	14.65	59.90	135.45
1.6	0.750	0.750	8	4	14.90	34.86	95.27	1.8	0.750	0.625	7	5	14.19	68.20	151.37
1.6	0.750	0.750	6	5	14.38	48.15	120.23	1.8	0.750	0.625	8	5	13.98	59.22	134.14
1.6	0.750	0.750	7	5	14.59	39.78	104.83	1.8	0.750	0.750	7	4	14.00	40.10	104.15
1.6	0.750	0.750	8	5	14.55	34.28	94.14	1.8	0.750	0.750	8	4	14.08	34.00	92.86
1.6	0.875	0.625	6	4	12.71	80.84	168.12	1.8	0.750	0.750	7	5	14.04	38.71	101.84
1.6	0.875	0.625	7	4	12.41	71.47	150.23	1.8	0.750	0.750	8	5	14.11	33.57	92.07
1.6	0.875	0.625	8	4	12.19	60.65	129.60	1.8	0.875	0.625	7	4	11.68	69.19	149.46
1.6	0.875	0.625	6	5	12.03	80.65	167.57	1.8	0.875	0.625	8	4	11.44	59.11	126.31
1.6	0.875	0.625	7	5	11.78	69.32	146.26	1.8	0.875	0.625	7	5	11.19	67.50	142.39
1.6	0.875	0.625	8	5	11.57	59.83	127.98	1.8	0.875	0.625	8	5	10.96	58.51	123.15
1.6	0.875	0.750	6	4	11.67	47.83	109.32	1.8	0.875	0.750	7	4	10.75	40.35	94.48
1.6	0.875	0.750	7	4	11.49	41.72	97.71	1.8	0.875	0.750	8	4	10.60	34.31	83.17
1.6	0.875	0.750	8	4	11.36	35.17	85.32	1.8	0.875	0.750	7	5	10.32	39.21	92.51
1.6	0.875	0.750	6	4	11.36	35.17	85.32	1.8	0.875	0.750	8	5	10.18	33.94	82.47

PLATE AREA - 600.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
2.0	0.500	0.625	7	4	28.04	65.31	190.16	4.0	0.625	0.375	16	4	11.74	88.24	179.03
2.0	0.500	0.625	8	4	27.89	55.90	173.62	4.0	0.625	0.500	9	3	10.14	70.77	150.67
2.0	0.500	0.625	9	4	27.78	47.87	156.98	4.0	0.625	0.625	9	3	10.06	36.22	90.00
2.0	0.500	0.750	7	4	29.56	34.22	151.32	4.0	0.625	0.625	10	3	10.33	44.36	86.26
2.0	0.500	0.750	8	4	30.19	28.82	142.73	4.0	0.625	0.625	11	3	10.21	43.79	85.13
2.0	0.500	0.750	9	4	29.33	24.16	131.13	4.0	0.625	0.625	12	3	10.37	43.31	84.20
2.0	0.625	0.625	7	4	18.74	67.30	162.50	4.0	0.625	0.750	9	3	10.21	20.25	64.11
2.0	0.625	0.625	8	4	18.55	57.74	144.91	4.0	0.625	0.750	10	3	10.48	18.02	60.39
2.0	0.625	0.625	9	4	18.40	50.07	129.51	4.0	0.625	0.750	11	3	10.22	15.87	55.63
2.0	0.625	0.750	7	4	19.02	37.23	115.96	4.0	0.625	0.750	12	3	10.38	27.75	54.35
2.0	0.625	0.750	8	4	19.48	31.76	106.45								
2.0	0.625	0.750	9	4	19.07	27.15	96.51								
2.0	0.750	0.625	7	4	13.81	67.44	148.72								
2.0	0.750	0.625	8	4	13.98	57.88	130.79								
2.0	0.750	0.625	9	4	13.41	50.69	116.70								
2.0	0.750	0.750	7	4	13.05	38.43	99.56								
2.0	0.750	0.750	8	4	13.40	32.89	89.52								
2.0	0.750	0.750	9	4	13.21	28.45	80.51								
2.0	0.875	0.500	9	4	11.97	95.42	191.94								
2.0	0.875	0.625	7	4	10.92	66.43	139.58								
2.0	0.875	0.625	8	4	10.66	57.10	121.94								
2.0	0.875	0.625	9	4	10.47	50.45	109.05								
2.0	1.000	0.500	8	4	10.51	100.70	199.35								
2.0	1.000	0.500	9	4	10.16	91.15	180.96								
4.0	0.500	0.500	9	3	14.42	90.60	176.05								
4.0	0.500	0.500	10	3	14.80	89.33	173.57								
4.0	0.500	0.500	11	3	14.63	88.30	171.57								
4.0	0.500	0.500	12	3	14.88	87.45	169.92								
4.0	0.500	0.625	9	3	15.88	34.81	106.47								
4.0	0.500	0.625	10	3	16.32	52.13	102.04								
4.0	0.500	0.625	11	3	15.92	51.74	101.26								
4.0	0.500	0.625	12	3	16.20	51.41	100.62								
4.0	0.500	0.750	9	3	15.50	18.53	82.98								
4.0	0.500	0.750	10	3	15.89	16.39	79.89								
4.0	0.500	0.750	11	3	15.29	14.18	73.88								
4.0	0.500	0.750	12	3	15.50	12.77	71.69								
4.0	0.625	0.375	15	4	11.91	93.93	189.92								

PLATE AREA - 650.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.750	5	5	30.08	60.29	195.78	1.2	0.875	0.625	7	5	12.95	84.78	171.07
1.0	0.500	0.750	6	5	29.94	60.12	195.16	1.2	0.875	0.625	6	6	12.82	86.94	178.41
1.0	0.500	0.750	5	6	29.82	60.12	195.16	1.2	0.875	0.625	7	6	12.68	75.93	158.75
1.0	0.500	0.750	6	6	29.69	44.32	161.11	1.2	0.875	0.750	6	5	12.17	51.71	116.16
1.0	0.625	0.625	6	6	19.87	82.62	186.94	1.2	0.875	0.750	7	5	12.09	51.20	109.41
1.0	0.625	0.750	6	5	19.79	62.15	160.34	1.2	0.875	0.750	6	6	11.97	51.36	115.31
1.0	0.625	0.750	6	5	19.63	61.88	159.55	1.2	0.875	0.750	7	6	11.90	44.17	102.47
1.0	0.625	0.750	5	6	19.52	61.88	159.55	1.2	1.000	0.625	6	5	10.85	84.06	169.79
1.0	0.625	0.750	6	6	19.36	46.56	128.44	1.2	1.000	0.625	7	5	10.65	79.78	158.79
1.0	0.750	0.625	6	6	14.60	81.09	172.16	1.2	1.000	0.625	6	6	10.57	82.86	167.31
1.0	0.750	0.750	5	5	14.32	61.96	142.61	1.2	1.000	0.625	7	6	10.39	73.82	150.44
1.0	0.750	0.750	6	5	14.16	61.53	141.54	1.4	0.500	0.625	8	5	34.59	66.17	199.61
1.0	0.750	0.750	5	6	14.06	61.53	141.54	1.4	0.500	0.750	6	5	34.31	50.53	194.63
1.0	0.750	0.750	6	6	13.89	46.95	112.71	1.4	0.500	0.750	7	5	35.23	40.02	177.12
1.0	0.875	0.625	6	6	11.50	78.53	161.23	1.4	0.625	0.625	7	5	22.99	79.21	189.97
1.0	0.875	0.750	5	5	11.09	60.74	131.41	1.4	0.625	0.625	8	5	22.86	79.40	169.30
1.0	0.875	0.750	6	5	10.94	60.11	129.98	1.4	0.625	0.750	6	5	22.41	53.51	152.87
1.0	0.875	0.750	5	6	10.83	60.11	129.98	1.4	0.625	0.750	7	5	22.55	43.75	135.80
1.0	0.875	0.750	6	6	10.67	46.46	103.35	1.4	0.750	0.625	7	5	16.79	79.75	175.13
1.0	1.000	0.625	5	5	10.09	96.28	192.32	1.4	0.750	0.625	8	5	16.63	76.05	155.81
1.2	0.500	0.750	6	5	33.76	48.73	184.30	1.4	0.750	0.750	6	5	16.10	54.20	132.97
1.2	0.500	0.750	7	5	33.86	38.98	169.35	1.4	0.750	0.750	7	5	16.03	45.32	117.03
1.2	0.500	0.750	6	6	33.55	48.63	183.82	1.4	0.875	0.625	6	5	13.36	90.76	187.54
1.2	0.500	0.750	7	6	33.69	38.91	169.00	1.4	0.875	0.625	7	5	13.14	78.84	165.25
1.2	0.625	0.625	7	6	22.37	76.80	182.78	1.4	0.875	0.625	8	5	12.95	71.86	144.20
1.2	0.625	0.750	6	5	22.05	51.49	145.49	1.4	0.875	0.750	6	5	12.38	53.79	121.32
1.2	0.625	0.750	7	5	22.07	53.20	133.20	1.4	0.875	0.750	7	5	12.26	45.81	106.79
1.2	0.625	0.750	6	6	21.84	51.33	144.95	1.4	1.000	0.625	6	5	11.07	87.07	176.07
1.2	0.625	0.750	7	6	21.89	42.41	130.03	1.4	1.000	0.625	7	5	10.81	76.85	156.86
1.2	0.750	0.625	6	5	16.65	90.10	192.68	1.4	1.000	0.625	8	5	10.60	66.29	136.52
1.2	0.750	0.625	7	5	16.55	89.25	184.44	1.4	1.000	0.750	6	5	10.01	52.70	113.14
1.2	0.750	0.625	6	6	16.35	89.41	191.12	1.6	0.500	0.750	6	4	34.83	50.59	197.03
1.2	0.750	0.625	7	6	16.27	77.06	168.47	1.6	0.500	0.750	7	4	34.75	42.60	181.00
1.2	0.750	0.750	6	5	15.83	52.12	127.00	1.6	0.500	0.750	8	4	34.83	34.91	166.63
1.2	0.750	0.750	7	5	15.80	52.64	118.91	1.6	0.500	0.750	6	5	34.57	50.70	196.56
1.2	0.750	0.750	6	6	15.63	51.87	126.32	1.6	0.500	0.750	7	5	35.08	39.68	176.46
1.2	0.750	0.750	7	6	15.61	43.82	112.27	1.6	0.500	0.750	8	5	34.85	34.04	164.97
1.2	0.875	0.625	6	5	13.11	87.48	180.41								

PLATE AREA - 650.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL				
1.6	0.625	0.625	7	5	22.21	78.58	189.04	1.8	0.625	0.625	9	4	21.66	59.27	150.58				
1.6	0.625	0.625	8	5	22.04	68.14	168.75	1.8	0.625	0.625	7	5	20.90	76.42	183.96				
1.6	0.625	0.750	6	4	22.85	53.62	154.32	1.8	0.625	0.625	8	5	20.71	66.67	165.28				
1.6	0.625	0.750	7	4	22.72	45.91	139.37	1.8	0.625	0.625	9	5	20.57	57.05	146.77				
1.6	0.625	0.750	8	4	22.63	38.24	125.00	1.8	0.625	0.750	7	4	21.36	44.14	134.35				
1.6	0.625	0.750	6	5	21.94	53.74	154.14	1.8	0.625	0.750	8	4	21.71	37.27	121.85				
1.6	0.625	0.750	7	5	22.48	43.40	135.19	1.8	0.625	0.750	7	5	21.68	42.21	131.28				
1.6	0.625	0.750	8	5	22.37	37.47	123.51	1.8	0.625	0.750	8	5	21.75	36.70	120.83				
1.6	0.750	0.625	7	5	16.26	79.13	174.06	1.8	0.750	0.625	7	4	16.13	79.46	173.82				
1.6	0.750	0.625	8	5	16.06	68.39	153.30	1.8	0.750	0.625	8	4	15.90	67.69	151.52				
1.6	0.750	0.750	6	4	16.45	54.36	134.00	1.8	0.750	0.625	9	4	15.72	59.83	136.25				
1.6	0.750	0.750	7	4	16.28	47.05	120.00	1.8	0.750	0.625	7	5	15.37	77.00	169.41				
1.6	0.750	0.750	8	4	16.16	39.48	105.72	1.8	0.750	0.625	8	5	15.14	66.90	150.02				
1.6	0.750	0.750	6	5	15.55	54.46	133.91	1.8	0.750	0.625	9	5	14.97	58.01	133.02				
1.6	0.750	0.750	7	5	15.46	44.97	116.40	1.8	0.750	0.750	7	4	15.19	45.38	115.85				
1.6	0.875	0.625	7	5	12.76	78.25	164.16	1.8	0.750	0.750	8	4	15.05	38.49	103.07				
1.6	0.875	0.625	8	5	12.53	67.56	143.57	1.8	0.750	0.750	7	5	14.88	43.76	113.14				
1.6	0.875	0.750	6	4	12.66	54.03	122.24	1.8	0.875	0.625	7	4	12.67	78.12	163.35				
1.6	0.875	0.750	7	4	12.46	47.17	109.17	1.8	0.875	0.625	8	4	12.41	66.74	141.71				
1.6	0.875	0.750	8	4	12.32	39.77	95.16	1.8	0.875	0.625	9	4	12.21	59.42	127.60				
1.6	0.875	0.750	6	5	12.00	54.05	122.06	1.8	0.875	0.625	7	5	12.12	76.18	159.81				
1.6	0.875	0.750	7	5	11.85	45.48	106.16	1.8	0.875	0.625	8	5	11.87	66.06	140.39				
1.6	0.875	0.750	8	5	11.72	39.18	94.01	1.8	0.875	0.625	9	5	11.67	57.96	124.93				
1.6	1.000	0.625	7	5	10.54	76.27	155.73	1.8	0.875	0.750	7	4	11.66	45.61	105.57				
1.6	1.000	0.625	8	5	10.30	65.97	135.92	1.8	0.875	0.750	8	4	11.50	38.79	92.78				
1.6	1.000	0.750	6	4	10.25	53.05	114.10	1.8	0.875	0.750	7	5	11.18	44.28	103.26				
1.6	1.000	0.750	7	4	10.03	46.67	101.98	1.8	0.875	0.750	8	5	11.03	38.36	91.97				
1.8	0.500	0.625	8	4	32.90	65.68	198.50	1.8	1.000	0.625	7	4	10.48	75.84	154.54				
1.8	0.500	0.625	9	4	32.79	56.97	180.66	1.8	1.000	0.625	8	4	10.20	65.09	134.03				
1.8	0.500	0.625	8	5	31.20	64.56	196.46	1.8	1.000	0.625	7	5	10.07	74.27	151.62				
1.8	0.500	0.625	9	5	31.10	54.33	176.47	2.0	0.500	0.625	8	4	30.26	63.42	191.66				
1.8	0.500	0.750	7	4	33.34	40.85	174.26	2.0	0.500	0.625	9	4	30.14	54.36	172.54				
1.8	0.500	0.750	8	4	33.78	34.01	162.31	2.0	0.500	0.625	8	5	29.25	62.57	190.19				
1.8	0.500	0.750	7	5	33.76	38.60	171.07	2.0	0.500	0.625	9	5	28.93	52.27	169.39				
1.8	0.500	0.750	8	5	33.84	33.36	161.22	2.0	0.500	0.750	7	4	31.49	39.00	165.79				
1.8	0.625	0.625	7	4	22.00	79.55	189.41	2.0	0.500	0.750	8	4	32.19	32.91	155.05				
1.8	0.625	0.625	8	4	21.81	67.61	167.05	2.0	0.500	0.750	9	4	31.30	27.64	143.20				

PLATE AREA - 650.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
2.0	0.625	0.625	7	4	20.33	76.08	181.21	4.0	0.500	0.750	12	3	17.01	14.47	79.17
2.0	0.625	0.625	8	4	20.12	65.31	161.31	4.0	0.500	0.750	13	3	16.54	12.83	74.63
2.0	0.625	0.625	9	4	19.97	56.66	143.98	4.0	0.625	0.375	17	4	12.56	93.72	190.09
2.0	0.625	0.625	7	5	19.42	73.57	176.91	4.0	0.625	0.500	10	3	10.77	81.34	157.70
2.0	0.625	0.625	8	5	19.22	64.60	160.02	4.0	0.625	0.500	11	3	10.60	79.78	154.66
2.0	0.625	0.625	9	5	19.06	54.89	141.04	4.0	0.625	0.500	12	3	10.45	78.47	152.13
2.0	0.625	0.750	7	4	20.22	42.21	128.17	4.0	0.625	0.500	13	3	10.33	77.37	149.98
2.0	0.625	0.750	8	4	20.71	36.04	117.40	4.0	0.625	0.625	10	3	11.07	50.35	97.88
2.0	0.625	0.750	9	4	20.28	30.84	106.28	4.0	0.625	0.625	11	3	10.94	49.71	96.64
2.0	0.750	0.625	7	4	14.98	76.17	166.58	4.0	0.625	0.625	12	3	11.12	49.18	95.61
2.0	0.750	0.625	8	4	14.73	65.39	146.32	4.0	0.625	0.625	13	3	11.04	48.74	94.74
2.0	0.750	0.625	9	4	14.55	57.28	130.44	4.0	0.625	0.750	10	3	11.42	20.35	66.97
2.0	0.750	0.625	7	5	14.36	74.17	163.05	4.0	0.625	0.750	11	3	11.15	31.89	62.43
2.0	0.750	0.625	8	5	14.12	64.80	145.22	4.0	0.625	0.750	12	3	11.32	31.64	61.92
2.0	0.750	0.625	9	5	13.93	55.83	127.90	4.0	0.625	0.750	13	3	11.13	31.42	61.48
2.0	0.750	0.750	7	4	14.02	43.46	110.77	4.0	0.750	0.375	16	3	10.09	95.83	190.22
2.0	0.750	0.750	8	4	14.24	37.22	99.42	4.0	0.750	0.375	15	4	10.49	100.84	199.76
2.0	0.875	0.625	7	4	11.84	74.99	156.74	4.0	0.750	0.375	16	4	10.29	94.95	188.44
2.0	0.875	0.625	8	4	11.56	64.47	136.81	4.0	0.750	0.375	17	4	10.11	89.88	178.67
2.0	0.875	0.625	9	4	11.35	56.97	122.27								
2.0	0.875	0.625	7	5	11.39	73.41	153.89								
2.0	0.875	0.625	8	5	11.12	63.96	135.85								
2.0	0.875	0.625	9	5	10.92	55.79	120.16								
2.0	0.875	0.750	7	4	10.81	43.76	101.13								
2.0	0.875	0.750	8	4	10.65	37.51	89.54								
2.0	0.875	0.750	9	4	10.52	32.76	80.17								
4.0	0.500	0.500	10	3	15.67	101.14	196.50								
4.0	0.500	0.500	11	3	15.51	100.00	194.28								
4.0	0.500	0.500	12	3	15.77	99.06	192.44								
4.0	0.500	0.500	13	3	15.65	98.27	190.89								
4.0	0.500	0.625	10	3	17.52	59.19	115.80								
4.0	0.500	0.625	11	3	17.10	58.76	114.95								
4.0	0.500	0.625	12	3	17.40	58.41	114.24								
4.0	0.500	0.625	13	3	17.11	58.10	113.64								
4.0	0.500	0.750	10	3	17.39	18.56	88.26								
4.0	0.500	0.750	11	3	16.76	16.06	81.58								

PLATE AREA - 700.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.750	6	6	31.90	50.02	175.60	1.2	0.750	0.750	7	6	16.79	49.12	123.80
1.0	0.500	0.750	7	6	32.06	49.77	174.85	1.2	0.875	0.625	7	5	13.94	94.99	191.15
1.0	0.500	0.750	6	7	31.96	49.77	174.85	1.2	0.875	0.625	6	6	13.80	96.88	198.91
1.0	0.500	0.750	7	7	32.03	41.09	162.41	1.2	0.875	0.625	7	6	13.65	84.99	176.82
1.0	0.625	0.625	7	7	21.33	79.15	183.10	1.2	0.875	0.750	6	5	13.09	57.94	128.96
1.0	0.625	0.750	6	6	20.82	52.33	141.35	1.2	0.875	0.750	7	5	13.01	57.42	121.94
1.0	0.625	0.750	7	6	20.89	52.03	140.56	1.2	0.875	0.750	6	6	12.87	57.54	128.01
1.0	0.625	0.750	6	7	20.81	52.03	140.56	1.2	0.875	0.750	7	6	12.80	49.47	113.52
1.0	0.625	0.750	7	7	20.83	44.00	127.46	1.2	1.000	0.625	6	5	11.68	94.09	189.52
1.0	0.750	0.625	6	6	15.71	90.85	191.72	1.2	1.000	0.625	7	5	11.47	89.37	177.56
1.0	0.750	0.625	7	6	15.67	90.00	189.89	1.2	1.000	0.625	6	6	11.38	92.74	186.74
1.0	0.750	0.625	6	7	15.56	90.00	189.89	1.2	1.000	0.625	7	6	11.19	82.61	167.81
1.0	0.750	0.625	7	7	15.51	78.79	169.43	1.2	1.000	0.750	6	5	10.58	56.77	120.81
1.0	0.750	0.750	6	6	14.94	52.68	124.79	1.2	1.000	0.750	7	5	10.47	55.21	113.77
1.0	0.750	0.750	7	6	14.95	52.33	123.92	1.2	1.000	0.750	6	6	10.37	56.24	119.62
1.0	0.750	0.750	6	7	14.87	52.33	123.92	1.2	1.000	0.750	7	6	10.26	49.10	106.62
1.0	0.750	0.750	7	7	14.86	45.01	111.31	1.4	0.500	0.750	7	5	37.05	45.15	191.96
1.0	0.875	0.625	6	6	12.37	87.94	179.87	1.4	0.500	0.750	8	5	36.96	38.62	177.95
1.0	0.875	0.625	7	6	12.28	86.87	177.61	1.4	0.500	0.750	7	6	37.00	45.08	191.66
1.0	0.875	0.625	6	7	12.17	86.87	177.61	1.4	0.500	0.750	8	6	36.82	38.58	177.69
1.0	0.875	0.625	7	7	12.08	77.20	159.77	1.4	0.625	0.625	8	5	24.61	89.08	188.73
1.0	0.875	0.750	6	6	11.48	52.08	114.84	1.4	0.625	0.625	8	6	24.39	76.40	185.64
1.0	0.875	0.750	7	6	11.45	51.64	113.83	1.4	0.625	0.750	6	5	24.09	60.09	167.97
1.0	0.875	0.750	6	7	11.37	45.07	102.19	1.4	0.625	0.750	7	5	24.10	49.11	148.63
1.0	1.000	0.625	6	6	10.25	84.33	169.41	1.4	0.625	0.750	8	5	24.04	42.22	134.70
1.0	1.000	0.625	7	6	10.13	82.98	166.66	1.4	0.625	0.750	6	6	23.91	59.96	167.53
1.0	1.000	0.625	6	7	10.02	82.98	166.66	1.4	0.625	0.750	7	6	23.95	48.97	148.22
1.2	0.500	0.750	7	5	36.39	43.97	183.46	1.4	0.625	0.750	8	6	23.89	42.13	134.38
1.2	0.500	0.750	7	6	36.22	43.93	183.16	1.4	0.750	0.625	7	5	18.07	89.25	194.45
1.2	0.625	0.750	6	5	23.70	57.85	159.92	1.4	0.750	0.625	8	5	17.90	85.28	174.07
1.2	0.625	0.750	7	5	23.73	59.77	147.30	1.4	0.750	0.625	7	6	17.85	88.75	193.35
1.2	0.625	0.750	6	6	23.48	57.66	159.30	1.4	0.750	0.625	8	6	17.68	76.48	169.47
1.2	0.625	0.750	7	6	23.54	47.63	142.37	1.4	0.750	0.750	6	5	17.31	60.76	147.00
1.2	0.750	0.625	7	6	17.51	86.28	187.18	1.4	0.750	0.750	7	5	17.25	50.77	128.99
1.2	0.750	0.750	6	5	17.03	58.45	140.46	1.4	0.750	0.750	8	5	17.15	43.61	114.87
1.2	0.750	0.750	7	5	16.99	59.07	132.14	1.4	0.750	0.750	6	6	17.13	60.57	146.48
1.2	0.750	0.750	6	6	16.80	58.16	139.70	1.4	0.750	0.750	7	6	17.09	50.54	128.42
1.2	0.750	0.750	6	6	16.80	58.16	139.70	1.4	0.750	0.750	8	6	17.00	43.47	114.46

PLATE AREA - 700.0000

MAXIMUM STRESSES										MAXIMUM STRESSES									
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL				
1.4	0.875	0.625	7	5	14.14	88.21	183.97	1.6	1.000	0.750	7	5	10.29	50.67	110.47				
1.4	0.875	0.625	8	5	13.94	80.56	161.28	1.6	1.000	0.750	8	5	10.13	43.66	96.99				
1.4	0.875	0.625	7	6	13.93	87.48	182.44	1.8	0.500	0.625	9	4	35.35	64.08	197.73				
1.4	0.875	0.625	8	6	13.73	75.40	159.07	1.8	0.500	0.625	9	5	33.48	61.07	192.89				
1.4	0.875	0.750	6	5	13.31	60.24	134.63	1.8	0.500	0.750	7	4	35.20	46.12	189.50				
1.4	0.875	0.750	7	5	13.19	51.28	118.25	1.8	0.500	0.750	8	4	35.69	38.47	176.11				
1.4	0.875	0.750	8	5	13.08	44.00	104.08	1.8	0.500	0.750	9	4	35.08	32.77	163.26				
1.4	0.875	0.750	6	6	13.14	59.98	133.99	1.8	0.500	0.750	7	5	35.66	43.54	185.76				
1.4	0.875	0.750	7	6	13.04	50.95	117.50	1.8	0.500	0.750	8	5	35.76	37.73	174.85				
1.4	0.875	0.750	8	6	12.93	43.79	103.55	1.8	0.500	0.750	9	5	35.49	31.05	161.04				
1.4	1.000	0.625	6	5	11.92	97.43	196.47	1.8	0.625	0.625	8	4	23.51	75.79	184.57				
1.4	1.000	0.625	7	5	11.64	85.97	174.90	1.8	0.625	0.625	8	4	23.35	66.47	166.19				
1.4	1.000	0.625	8	5	11.42	74.18	152.17	1.8	0.625	0.625	9	5	22.30	74.73	182.56				
1.4	1.000	0.625	6	6	11.69	96.48	194.50	1.8	0.625	0.625	7	4	22.79	49.59	147.40				
1.4	1.000	0.625	7	6	11.43	85.04	173.01	1.8	0.625	0.750	8	4	22.90	41.90	133.39				
1.4	1.000	0.625	8	6	11.22	73.50	150.74	1.8	0.625	0.750	9	4	22.63	36.30	121.86				
1.4	1.000	0.750	6	5	10.77	59.00	125.86	1.8	0.625	0.750	7	5	22.86	47.38	143.83				
1.4	1.000	0.750	7	5	10.61	51.02	111.15	1.8	0.625	0.750	8	5	22.95	41.25	132.21				
1.4	1.000	0.750	8	5	10.48	43.79	97.18	1.8	0.625	0.750	9	5	22.92	34.78	119.53				
1.4	1.000	0.750	6	6	10.61	58.64	125.04	1.8	0.750	0.625	7	4	17.39	88.96	193.14				
1.4	1.000	0.750	7	6	10.46	50.60	110.24	1.8	0.750	0.625	8	4	17.14	75.79	168.17				
1.4	1.000	0.750	8	6	10.33	43.51	96.53	1.8	0.750	0.625	9	4	16.95	67.01	151.10				
1.6	0.500	0.750	7	5	36.97	44.77	191.41	1.8	0.750	0.625	8	5	16.55	86.16	188.09				
1.6	0.500	0.750	8	5	36.74	38.51	178.73	1.8	0.750	0.625	9	5	16.30	74.90	166.47				
1.6	0.625	0.625	8	5	23.73	76.38	186.38	1.8	0.750	0.625	8	5	16.12	64.93	147.41				
1.6	0.625	0.750	7	5	23.66	48.72	148.03	1.8	0.750	0.750	7	4	16.37	50.87	127.90				
1.6	0.625	0.750	8	5	23.55	42.12	135.07	1.8	0.750	0.750	8	4	16.23	43.17	113.58				
1.6	0.750	0.625	7	5	17.50	88.55	193.26	1.8	0.750	0.750	8	4	16.12	37.77	102.88				
1.6	0.750	0.625	8	5	17.29	76.58	170.10	1.8	0.750	0.750	9	5	15.69	49.01	124.76				
1.6	0.750	0.750	7	5	16.64	50.38	128.32	1.8	0.750	0.750	8	5	15.76	42.60	112.53				
1.6	0.750	0.750	8	5	16.52	43.52	114.97	1.8	0.750	0.750	9	5	15.85	36.45	100.70				
1.6	0.875	0.625	7	5	13.74	87.53	182.73	1.8	0.975	0.625	7	4	13.66	87.41	181.92				
1.6	0.875	0.625	8	5	13.50	75.61	159.74	1.8	0.875	0.625	8	4	13.38	74.69	157.69				
1.6	0.875	0.750	7	5	12.76	50.90	117.56	1.8	0.875	0.625	8	4	13.16	66.51	141.92				
1.6	0.875	0.750	8	5	12.61	43.89	104.01	1.8	0.875	0.625	9	4	13.05	89.21	177.88				
1.6	1.000	0.625	7	5	11.35	85.30	173.62	1.8	0.875	0.625	8	5	12.78	73.92	156.20				
1.6	1.000	0.625	8	5	11.09	73.80	151.48	1.8	0.875	0.625	9	5	12.78	73.92	156.20				

PLATE AREA - 700.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.8	0.875	0.625	9	5	12.57	64.84	138.87	2.0	0.750	0.625	9	5	15.00	62.49	141.75
1.8	0.875	0.750	7	4	12.57	51.07	117.03	2.0	0.750	0.750	7	4	15.12	48.71	122.32
1.8	0.875	0.750	8	4	12.40	43.45	102.70	2.0	0.750	0.750	8	4	15.03	41.73	109.59
1.8	0.875	0.750	9	4	12.28	38.30	92.67	2.0	0.750	0.750	9	4	14.85	36.14	98.30
1.8	0.875	0.750	7	5	12.04	49.55	114.37	2.0	0.750	0.750	7	5	14.88	47.21	119.84
1.8	0.875	0.750	8	5	11.87	42.96	101.77	2.0	0.750	0.750	8	5	15.08	41.30	108.83
1.8	0.875	0.750	9	5	11.75	37.18	90.75	2.0	0.750	0.750	9	5	15.02	35.09	96.62
1.8	1.000	0.625	7	4	11.30	84.84	172.34	2.0	0.875	0.625	7	4	12.77	83.89	174.54
1.8	1.000	0.625	8	4	10.99	72.82	149.38	2.0	0.875	0.625	8	4	12.47	72.13	152.23
1.8	1.000	0.625	9	4	10.76	65.29	134.91	2.0	0.875	0.625	9	4	12.24	63.75	135.98
1.8	1.000	0.625	7	5	10.84	83.06	169.02	2.0	0.875	0.625	7	5	12.27	82.10	171.29
1.8	1.000	0.625	8	5	10.55	72.11	147.99	2.0	0.875	0.625	8	5	11.98	71.56	151.14
1.8	1.000	0.625	9	5	10.32	63.93	132.39	2.0	0.875	0.625	9	5	11.76	62.41	133.57
1.8	1.000	0.750	7	4	10.16	50.60	109.76	2.0	0.875	0.750	7	4	11.66	48.99	112.12
2.0	0.500	0.625	9	4	32.50	61.12	198.88	2.0	0.875	0.750	8	4	11.48	42.01	99.14
2.0	0.500	0.625	9	5	30.94	58.74	185.25	2.0	0.875	0.750	9	5	11.35	36.70	88.68
2.0	0.500	0.750	7	4	33.33	44.01	180.44	2.0	0.875	0.750	7	5	11.23	47.75	109.99
2.0	0.500	0.750	8	4	34.09	37.20	169.50	2.0	0.875	0.750	8	5	11.05	41.64	98.46
2.0	0.500	0.750	9	4	33.16	31.30	155.33	2.0	0.875	0.750	9	5	10.92	35.80	87.17
2.0	0.500	0.750	7	5	33.76	41.95	177.66	2.0	1.000	0.625	7	4	10.63	81.48	165.44
2.0	0.500	0.750	8	5	34.18	36.63	168.64	2.0	1.000	0.625	8	4	10.30	70.28	144.11
2.0	0.500	0.750	9	5	33.55	29.93	153.77	2.0	1.000	0.625	9	4	10.06	62.62	129.33
2.0	0.625	0.625	8	4	21.70	73.20	178.25	2.0	1.000	0.625	7	5	10.26	80.04	152.78
2.0	0.625	0.625	9	4	21.53	63.52	158.91	4.0	0.500	0.625	10	3	18.67	66.55	130.12
2.0	0.625	0.625	7	5	20.91	82.38	195.62	4.0	0.500	0.625	11	3	18.23	66.08	129.20
2.0	0.625	0.625	8	5	20.69	72.39	176.78	4.0	0.500	0.625	12	3	18.55	65.69	128.43
2.0	0.625	0.625	9	5	20.53	61.51	155.53	4.0	0.500	0.625	13	3	18.24	65.36	127.78
2.0	0.625	0.750	7	4	21.36	47.40	140.69	4.0	0.500	0.750	10	3	18.84	20.84	96.67
2.0	0.625	0.750	8	4	21.89	40.51	128.60	4.0	0.500	0.750	11	3	18.17	18.03	89.30
2.0	0.625	0.750	9	4	21.44	34.70	116.23	4.0	0.500	0.750	12	3	18.46	16.27	86.65
2.0	0.625	0.750	7	5	21.68	45.62	137.93	4.0	0.500	0.750	13	3	17.97	14.42	81.65
2.0	0.625	0.750	8	5	21.95	40.01	127.76	4.0	0.625	0.500	10	3	11.60	91.20	176.81
2.0	0.625	0.750	9	5	21.71	33.48	114.49	4.0	0.625	0.500	11	3	11.41	89.46	173.44
2.0	0.750	0.625	7	4	16.15	85.25	185.08	4.0	0.625	0.500	12	3	11.26	88.01	170.63
2.0	0.750	0.625	8	4	15.89	73.21	162.40	4.0	0.625	0.500	13	3	11.13	86.79	168.29
2.0	0.750	0.625	9	4	15.68	64.14	144.65	4.0	0.625	0.625	10	3	11.79	56.58	109.99
2.0	0.750	0.625	7	5	15.46	82.98	181.04	4.0	0.625	0.625	11	3	11.65	55.88	108.63
2.0	0.750	0.625	8	5	15.20	72.54	161.15	4.0	0.625	0.625	12	3	11.84	55.30	107.50

PLATE AREA - 700.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
4.0	0.625	0.625	13	3	11.75	54.82	106.54
4.0	0.625	0.750	10	3	12.32	22.78	73.65
4.0	0.625	0.750	11	3	12.03	35.96	70.36
4.0	0.625	0.750	12	3	12.23	35.69	69.81
4.0	0.625	0.750	13	3	12.02	35.45	69.34
4.0	0.750	0.375	17	4	10.89	100.46	199.38
4.0	0.750	0.375	18	4	10.71	95.19	189.25
4.0	0.750	0.375	17	5	10.68	99.48	197.50
4.0	0.750	0.375	18	5	10.51	94.40	187.72

PLATE AREA - 750.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.750	6	6	34.12	55.95	190.41	1.2	0.875	0.625	7	6	14.62	94.39	195.52
1.0	0.500	0.750	7	6	34.30	55.67	189.57	1.2	0.875	0.625	8	6	14.46	81.14	169.84
1.0	0.500	0.750	6	7	34.20	55.67	189.57	1.2	0.875	0.750	6	5	14.01	64.41	142.19
1.0	0.500	0.750	7	7	34.28	46.03	175.47	1.2	0.875	0.750	7	5	13.92	63.89	134.91
1.0	0.625	0.750	6	6	22.27	58.33	154.63	1.2	0.875	0.750	6	6	13.77	63.96	141.14
1.0	0.625	0.750	7	6	22.36	57.99	153.75	1.2	0.875	0.750	7	6	13.71	54.98	124.93
1.0	0.625	0.750	6	7	22.27	57.99	153.75	1.2	1.000	0.625	7	5	12.29	99.33	197.03
1.0	0.625	0.750	7	7	22.30	49.06	139.02	1.2	1.000	0.625	8	5	12.10	97.74	193.84
1.0	0.750	0.625	7	7	16.61	87.58	187.12	1.2	1.000	0.625	7	6	11.99	91.73	185.81
1.0	0.750	0.750	6	6	15.99	58.64	137.26	1.2	1.000	0.625	8	6	11.81	79.16	161.52
1.0	0.750	0.750	7	6	16.00	58.23	136.29	1.2	1.000	0.750	6	5	11.33	63.08	133.49
1.0	0.750	0.750	6	7	15.92	58.24	136.29	1.2	1.000	0.750	7	5	11.21	61.41	126.06
1.0	0.750	0.750	7	7	15.91	50.09	122.16	1.2	1.000	0.750	6	6	11.10	62.49	132.17
1.0	0.875	0.625	6	6	13.25	97.72	199.18	1.2	1.000	0.750	7	6	10.99	54.54	117.66
1.0	0.875	0.625	7	6	13.16	96.52	196.68	1.4	0.500	0.750	8	5	39.54	43.32	191.69
1.0	0.875	0.625	6	7	13.04	96.52	196.68	1.4	0.500	0.750	8	6	39.39	43.28	191.43
1.0	0.875	0.625	7	7	12.94	85.79	176.81	1.4	0.625	0.750	7	5	25.80	54.68	161.76
1.0	0.875	0.750	6	6	12.29	57.92	126.73	1.4	0.625	0.750	8	5	25.73	47.09	146.45
1.0	0.875	0.750	7	6	12.26	57.43	125.61	1.4	0.625	0.750	7	6	25.64	54.55	161.37
1.0	0.875	0.750	6	7	12.17	57.43	125.61	1.4	0.625	0.750	8	6	25.57	47.00	146.12
1.0	0.875	0.750	7	7	12.13	50.12	112.59	1.4	0.625	0.750	8	5	19.17	94.87	193.00
1.0	1.000	0.625	6	6	10.97	93.68	187.77	1.4	0.750	0.625	8	6	18.94	84.98	186.81
1.0	1.000	0.625	7	6	10.85	92.18	184.72	1.4	0.750	0.750	7	5	18.46	56.44	141.29
1.0	1.000	0.625	6	7	10.73	92.18	184.72	1.4	0.750	0.750	8	5	18.36	48.53	125.72
1.0	1.000	0.625	7	7	10.61	83.07	167.72	1.4	0.750	0.750	7	6	18.30	56.20	140.70
1.2	0.500	0.750	7	5	38.93	49.16	197.79	1.4	0.750	0.750	8	6	18.20	48.38	125.28
1.2	0.500	0.750	7	6	38.74	49.16	197.53	1.4	0.875	0.625	8	5	14.93	89.60	179.00
1.2	0.625	0.625	6	6	25.98	92.28	195.73	1.4	0.875	0.625	8	6	14.70	83.74	175.77
1.2	0.625	0.750	6	5	25.35	64.47	174.75	1.4	0.875	0.750	7	5	14.13	56.95	130.07
1.2	0.625	0.750	7	5	25.40	66.50	161.85	1.4	0.875	0.750	8	5	14.00	48.91	114.40
1.2	0.625	0.750	6	6	25.11	64.24	174.07	1.4	0.875	0.750	7	6	13.96	56.60	129.27
1.2	0.625	0.750	7	6	25.19	53.07	155.02	1.4	0.875	0.750	8	6	13.84	48.68	113.83
1.2	0.750	0.625	8	6	18.62	82.30	180.09	1.4	1.000	0.625	7	5	12.47	95.43	193.58
1.2	0.750	0.750	6	5	18.22	65.02	154.34	1.4	1.000	0.625	8	5	12.23	82.37	168.39
1.2	0.750	0.750	7	5	18.19	65.76	145.82	1.4	1.000	0.625	7	6	12.25	94.41	191.51
1.2	0.750	0.750	6	6	17.98	64.70	153.50	1.4	1.000	0.625	8	6	12.01	81.61	166.80
1.2	0.750	0.750	7	6	17.97	54.63	135.68	1.4	1.000	0.750	7	5	11.37	56.65	122.60

PLATE AREA - 750.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.4	1.000	0.750	8	5	11.22	48.65	107.12	1.8	0.875	0.625	8	5	13.69	82.08	172.56
1.4	1.000	0.750	7	6	11.21	56.19	121.61	1.8	0.875	0.625	9	5	13.47	71.99	153.28
1.4	1.000	0.750	8	6	11.06	48.34	106.41	1.8	0.875	0.750	7	5	12.90	55.02	125.82
								1.8	0.875	0.750	8	5	12.72	47.74	111.88
1.6	0.500	0.750	8	5	38.55	43.19	192.65	1.8	0.875	0.750	9	5	12.59	41.31	99.62
1.6	0.500	0.750	9	5	38.67	35.85	178.68	1.8	1.000	0.625	7	5	11.62	92.17	187.04
1.6	0.625	0.625	9	5	25.27	73.16	182.27	1.8	1.000	0.625	8	5	11.30	80.04	163.72
1.6	0.625	0.750	7	5	24.85	54.24	161.16	1.8	1.000	0.625	9	5	11.06	70.96	146.38
1.6	0.625	0.750	8	5	24.76	46.97	146.88	1.8	1.000	0.750	7	5	10.45	54.78	118.60
1.6	0.625	0.750	9	5	24.89	39.91	133.59	1.8	1.000	0.750	8	5	10.25	47.45	104.57
1.6	0.750	0.625	8	5	18.52	85.07	187.47	1.8	1.000	0.750	9	5	10.10	41.48	93.22
1.6	0.750	0.625	9	5	18.34	74.23	166.90								
1.6	0.750	0.750	7	5	17.82	55.99	140.57	2.0	0.500	0.625	10	4	34.76	60.43	191.95
1.6	0.750	0.750	8	5	17.69	48.41	125.84	2.0	0.500	0.625	10	5	33.04	59.04	189.73
1.6	0.750	0.750	9	5	17.59	41.71	113.25	2.0	0.500	0.750	8	4	35.91	41.69	183.08
1.6	0.875	0.625	8	5	14.46	83.96	176.47	2.0	0.500	0.750	9	4	34.95	35.13	167.55
1.6	0.875	0.625	9	5	14.26	74.09	157.73	2.0	0.500	0.750	10	4	35.45	30.67	160.38
1.6	0.875	0.750	7	5	13.66	56.53	129.31	2.0	0.500	0.750	8	5	36.00	41.04	182.09
1.6	0.875	0.750	8	5	13.51	48.78	114.33	2.0	0.500	0.750	9	5	35.36	33.57	165.72
1.6	0.875	0.750	9	5	13.39	42.50	102.52	2.0	0.500	0.750	10	5	35.65	29.86	159.39
1.6	1.000	0.625	7	5	12.16	94.68	192.14	2.0	0.625	0.625	8	4	23.28	81.39	195.71
1.6	1.000	0.625	8	5	11.88	81.93	167.59	2.0	0.625	0.625	9	4	23.10	70.65	174.28
1.6	1.000	0.625	9	5	11.66	73.05	150.69	2.0	0.625	0.625	10	4	22.96	62.86	159.87
1.6	1.000	0.750	7	5	11.02	56.25	121.84	2.0	0.625	0.625	8	5	22.17	80.48	194.05
1.6	1.000	0.750	8	5	10.85	48.50	106.91	2.0	0.625	0.625	9	5	21.99	68.38	170.44
1.6	1.000	0.750	9	5	10.71	42.67	95.93	2.0	0.625	0.625	10	5	21.85	61.66	157.81
								2.0	0.625	0.750	8	4	23.02	45.16	140.03
1.8	0.500	0.750	8	5	37.59	42.29	188.63	2.0	0.625	0.750	9	4	22.54	38.71	126.39
1.8	0.500	0.750	9	5	37.33	34.85	173.36	2.0	0.625	0.750	10	4	22.90	34.23	118.55
1.8	0.625	0.625	9	5	23.72	71.08	177.29	2.0	0.625	0.750	8	5	23.08	44.59	139.07
1.8	0.625	0.750	7	5	23.99	52.74	156.67	2.0	0.625	0.750	9	5	22.84	37.33	124.37
1.8	0.625	0.750	8	5	24.08	45.99	143.84	2.0	0.625	0.750	10	5	23.04	33.51	117.46
1.8	0.625	0.750	9	5	24.06	38.78	129.76	2.0	0.750	0.625	8	4	17.04	81.32	179.02
1.8	0.750	0.625	8	5	17.47	83.20	183.46	2.0	0.750	0.625	9	4	16.82	71.26	159.34
1.8	0.750	0.625	9	5	17.27	72.12	162.26	2.0	0.750	0.625	10	4	16.65	63.46	144.64
1.8	0.750	0.750	7	5	16.76	54.47	136.72	2.0	0.750	0.625	8	5	16.29	80.37	177.61
1.8	0.750	0.750	8	5	16.61	47.39	123.19	2.0	0.750	0.625	9	5	16.08	69.40	156.05
1.8	0.750	0.750	9	5	16.63	40.54	110.04	2.0	0.750	0.625	10	5	15.91	62.47	142.86
1.8	0.875	0.625	7	5	13.99	94.57	196.58	2.0	0.750	0.750	8	4	16.06	46.42	120.05

PLATE AREA - 750.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
2.0	0.750	0.750	9	4	15.93	40.22	107.55	4.0	0.625	0.500	11	4	12.97	77.85	166.35
2.0	0.750	0.750	10	4	15.84	35.71	99.33	4.0	0.625	0.500	12	4	12.80	71.70	154.91
2.0	0.750	0.750	8	5	15.84	45.94	119.18	4.0	0.625	0.500	13	4	12.65	65.27	142.25
2.0	0.750	0.750	9	5	15.79	39.02	105.63	4.0	0.625	0.500	14	4	12.52	70.16	136.10
2.0	0.750	0.750	10	5	15.94	35.08	98.28	4.0	0.625	0.625	10	3	12.47	63.06	122.56
2.0	0.875	0.625	8	4	13.37	80.09	168.19	4.0	0.625	0.625	11	3	12.32	62.29	121.07
2.0	0.875	0.625	9	4	13.13	70.79	150.17	4.0	0.625	0.625	12	3	12.53	61.66	119.84
2.0	0.875	0.625	10	4	12.93	63.10	135.57	4.0	0.625	0.625	13	3	12.43	61.13	118.80
2.0	0.875	0.625	8	5	12.84	79.44	166.97	4.0	0.625	0.625	14	3	12.57	60.67	117.91
2.0	0.875	0.625	9	5	12.60	69.28	147.44	4.0	0.625	0.750	10	3	13.18	25.31	80.44
2.0	0.875	0.625	10	5	12.41	62.28	134.06	4.0	0.625	0.750	11	3	12.88	40.19	78.61
2.0	0.875	0.750	8	4	12.32	46.68	109.03	4.0	0.625	0.750	12	3	13.10	39.90	78.02
2.0	0.875	0.750	9	4	12.17	40.79	97.44	4.0	0.625	0.750	13	3	12.88	39.64	77.51
2.0	0.875	0.750	10	4	12.06	36.27	89.04	4.0	0.625	0.750	14	3	13.02	39.42	77.07
2.0	0.875	0.750	8	5	11.84	46.26	108.26	4.0	0.750	0.500	10	4	10.46	85.00	173.24
2.0	0.875	0.750	9	5	11.70	39.77	95.72	4.0	0.750	0.500	11	4	10.21	76.67	157.05
2.0	0.875	0.750	10	5	11.59	35.73	88.09	4.0	0.750	0.500	12	4	10.01	70.53	145.45
2.0	1.000	0.625	8	4	11.05	78.00	159.43								
2.0	1.000	0.625	9	4	10.79	69.51	143.04								
2.0	1.000	0.625	10	4	10.57	62.07	128.86								
2.0	1.000	0.625	8	5	10.66	77.42	158.31								
2.0	1.000	0.625	9	5	10.40	68.28	140.79								
2.0	1.000	0.625	10	5	10.19	61.38	127.57								
4.0	0.500	0.500	11	4	18.18	76.90	179.95								
4.0	0.500	0.500	12	4	18.04	87.42	170.01								
4.0	0.500	0.500	13	4	17.92	86.81	168.81								
4.0	0.500	0.500	14	4	17.82	86.29	167.79								
4.0	0.500	0.625	10	3	19.76	74.18	144.98								
4.0	0.500	0.625	11	3	19.30	73.68	143.99								
4.0	0.500	0.625	12	3	19.65	73.26	143.16								
4.0	0.500	0.625	13	3	19.33	72.90	142.46								
4.0	0.500	0.625	14	3	19.57	72.59	141.85								
4.0	0.500	0.750	10	3	20.23	23.22	105.11								
4.0	0.500	0.750	11	3	19.53	20.09	97.03								
4.0	0.500	0.750	12	3	19.85	18.15	94.13								
4.0	0.500	0.750	13	3	19.34	16.09	88.66								
4.0	0.500	0.750	14	3	19.53	44.56	88.22								
4.0	0.625	0.500	10	4	13.19	87.38	185.13								

PLATE AREA - 800.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.500	0.750	7	7	36.52	51.15	188.76	1.2	0.875	0.750	7	6	14.61	60.68	136.70
1.0	0.625	0.750	6	6	23.72	64.56	168.28	1.2	0.875	0.750	8	6	14.51	51.99	119.70
1.0	0.625	0.750	7	6	23.82	64.17	167.30	1.2	1.000	0.625	8	6	12.60	87.32	177.64
1.0	0.625	0.750	6	7	23.73	64.17	167.29	1.2	1.000	0.750	6	5	12.08	69.61	146.58
1.0	0.625	0.750	7	7	23.77	54.31	150.88	1.2	1.000	0.750	7	5	11.95	67.83	138.77
1.0	0.750	0.750	6	6	17.03	64.81	150.11	1.2	1.000	0.750	8	5	11.83	67.14	137.30
1.0	0.750	0.750	7	6	17.06	64.35	149.04	1.2	1.000	0.750	6	6	11.83	68.95	145.13
1.0	0.750	0.750	6	7	16.97	64.35	149.04	1.2	1.000	0.750	7	6	11.72	60.18	129.05
1.0	0.750	0.750	7	7	16.96	55.37	133.34	1.2	1.000	0.750	8	6	11.61	51.62	112.44
1.0	0.875	0.625	7	7	13.80	94.67	194.41	1.4	0.625	0.750	7	5	27.49	60.45	175.20
1.0	0.875	0.750	6	6	13.09	63.97	139.01	1.4	0.625	0.750	8	5	27.41	52.13	158.45
1.0	0.875	0.750	7	6	13.06	63.42	137.76	1.4	0.625	0.750	7	6	27.32	60.33	174.82
1.0	0.875	0.750	6	7	12.97	63.42	137.76	1.4	0.625	0.750	8	6	27.25	52.04	158.11
1.0	0.875	0.750	7	7	12.93	55.35	123.32	1.4	0.750	0.750	7	5	19.68	62.30	153.93
1.0	1.000	0.625	7	7	11.32	91.65	184.61	1.4	0.750	0.750	8	5	19.57	53.62	136.86
1.0	1.000	0.750	6	6	10.59	62.48	130.82	1.4	0.750	0.750	7	6	19.51	62.06	153.33
1.0	1.000	0.750	7	6	10.53	61.80	129.34	1.4	0.750	0.750	8	6	19.40	53.46	136.39
1.0	1.000	0.750	6	7	10.43	61.80	129.34	1.4	0.875	0.625	8	5	15.92	98.95	197.33
1.0	1.000	0.750	7	7	10.37	54.65	116.34	1.4	0.875	0.625	8	6	15.68	92.37	193.01
1.2	0.500	0.750	8	6	41.27	46.74	194.92	1.4	0.875	0.750	7	5	15.06	62.83	142.25
1.2	0.625	0.750	6	5	27.01	71.32	189.98	1.4	0.875	0.750	8	5	14.93	53.99	125.04
1.2	0.625	0.750	7	5	27.06	73.69	176.83	1.4	0.875	0.750	7	6	14.89	62.46	141.40
1.2	0.625	0.750	8	5	27.02	73.48	176.24	1.4	0.875	0.750	8	6	14.75	53.74	124.42
1.2	0.625	0.750	6	6	26.74	71.07	189.22	1.4	1.000	0.625	8	5	13.04	90.84	185.14
1.2	0.625	0.750	7	6	26.84	58.70	167.98	1.4	1.000	0.625	8	6	12.81	90.01	183.40
1.2	0.625	0.750	8	6	26.80	50.38	150.97	1.4	1.000	0.750	7	5	12.12	62.48	134.41
1.2	0.750	0.625	8	6	19.85	90.84	197.40	1.4	1.000	0.750	8	5	11.96	53.68	117.39
1.2	0.750	0.750	5	5	19.41	71.84	158.55	1.4	1.000	0.750	7	6	11.95	61.98	133.34
1.2	0.750	0.750	7	5	19.39	72.68	159.94	1.4	1.000	0.750	8	6	11.80	53.34	116.61
1.2	0.750	0.750	8	5	19.31	72.35	159.14	1.6	0.500	0.750	9	5	40.47	39.93	191.31
1.2	0.750	0.750	6	6	19.15	71.48	167.71	1.6	0.500	0.750	9	6	40.39	39.86	191.08
1.2	0.750	0.750	7	6	19.15	60.33	147.90	1.6	0.625	0.625	9	5	26.94	80.79	198.61
1.2	0.750	0.750	8	6	19.08	51.72	130.81	1.6	0.625	0.625	9	6	26.75	80.65	198.23
1.2	0.875	0.625	8	6	15.42	89.52	186.56	1.6	0.625	0.750	7	5	26.50	59.97	174.59
1.2	0.875	0.750	6	5	14.93	71.10	195.85	1.6	0.625	0.750	8	5	26.39	52.00	158.95
1.2	0.875	0.750	7	5	14.84	70.58	148.31	1.6	0.625	0.750	9	5	26.31	44.19	144.25
1.2	0.875	0.750	8	5	14.75	70.09	147.20	1.6	0.625	0.750	7	6	26.35	59.81	174.20
1.2	0.875	0.750	6	6	14.68	70.61	154.68								

PLATE AREA - 800.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	0.625	0.750	8	6	26.25	51.92	158.69	1.8	0.750	0.750	7	5	17.87	60.12	148.99
1.6	0.625	0.750	9	6	26.18	44.09	143.97	1.8	0.750	0.750	8	5	17.71	52.35	134.14
1.6	0.750	0.625	9	5	19.56	90.77	182.87	1.8	0.750	0.750	9	5	17.59	44.79	119.61
1.6	0.750	0.625	9	6	19.37	81.60	181.97	1.8	0.875	0.625	8	5	14.61	90.51	189.44
1.6	0.750	0.750	7	5	19.00	61.81	153.16	1.8	0.875	0.625	9	5	14.37	79.38	168.16
1.6	0.750	0.750	8	5	18.86	53.49	136.99	1.8	0.875	0.625	10	5	14.18	71.17	152.37
1.6	0.750	0.750	9	5	18.75	46.09	123.06	1.8	0.875	0.750	7	5	13.75	60.69	137.61
1.6	0.750	0.750	7	6	18.86	61.57	152.52	1.8	0.875	0.750	8	5	13.57	52.68	122.28
1.6	0.750	0.750	8	6	18.72	53.37	136.66	1.8	0.875	0.750	9	5	13.42	45.59	108.74
1.6	0.875	0.750	9	6	18.62	45.94	122.69	1.8	1.000	0.625	8	5	12.06	88.25	179.98
1.6	0.875	0.625	8	5	15.42	92.60	193.75	1.8	1.000	0.625	9	5	11.80	78.23	160.83
1.6	0.875	0.625	9	5	15.20	81.71	173.04	1.8	1.000	0.625	10	5	11.59	70.16	145.32
1.6	0.875	0.625	9	6	15.24	92.16	192.80	1.8	1.000	0.750	7	5	11.14	60.40	130.02
1.6	0.875	0.625	9	6	15.02	81.26	172.09	1.8	1.000	0.750	8	5	10.93	52.34	114.58
1.6	0.875	0.750	7	5	14.57	62.36	141.42	1.8	1.000	0.750	9	5	10.77	45.75	102.04
1.6	0.875	0.750	8	5	14.40	53.84	124.95	2.0	0.500	0.750	8	4	37.65	46.35	196.81
1.6	0.875	0.750	9	5	14.28	46.90	111.89	2.0	0.500	0.750	9	4	36.65	39.12	179.87
1.6	0.875	0.750	7	6	14.43	62.03	140.71	2.0	0.500	0.750	10	4	37.20	34.21	171.94
1.6	0.875	0.750	8	6	14.27	53.66	124.52	2.0	0.500	0.750	8	5	37.75	45.63	195.69
1.6	0.875	0.750	9	6	14.15	46.70	111.41	2.0	0.500	0.750	9	5	37.10	37.37	177.76
1.6	1.000	0.625	8	5	12.67	90.35	184.24	2.0	0.500	0.750	10	5	37.42	33.30	170.79
1.6	1.000	0.625	9	5	12.43	80.94	163.57	2.0	0.500	0.625	9	5	23.46	75.50	185.77
1.6	1.000	0.625	8	6	12.49	89.77	183.04	2.0	0.625	0.625	10	5	23.31	68.12	171.86
1.6	1.000	0.625	9	6	12.26	79.97	164.38	2.0	0.625	0.625	8	4	24.10	49.98	151.70
1.6	1.000	0.750	7	5	11.75	62.03	133.56	2.0	0.625	0.750	8	4	23.79	42.87	136.74
1.6	1.000	0.750	8	5	11.57	53.50	117.14	2.0	0.625	0.750	9	4	23.99	37.94	128.07
1.6	1.000	0.750	9	5	11.42	47.07	105.00	2.0	0.625	0.750	10	4	23.17	49.35	150.62
1.6	1.000	0.750	7	6	11.62	61.62	132.71	2.0	0.625	0.750	8	5	23.92	41.33	134.44
1.6	1.000	0.750	8	6	11.44	53.27	116.61	2.0	0.625	0.750	9	5	24.14	37.13	126.83
1.6	1.000	0.750	9	6	11.30	46.80	104.41	2.0	0.750	0.625	8	5	17.38	88.88	194.58
1.8	0.500	0.750	9	5	39.09	38.81	185.78	2.0	0.750	0.625	9	5	17.15	76.55	170.78
1.8	0.625	0.625	9	5	25.30	78.49	193.20	2.0	0.750	0.625	10	5	15.97	68.93	156.26
1.8	0.625	0.625	10	5	25.16	70.53	177.98	2.0	0.750	0.750	8	4	17.15	51.28	130.79
1.8	0.625	0.750	7	5	25.08	58.31	169.79	2.0	0.750	0.750	9	4	17.02	44.49	117.03
1.8	0.625	0.750	8	5	25.17	50.90	155.72	2.0	0.750	0.750	10	4	16.91	39.48	107.95
1.8	0.625	0.750	9	5	25.16	42.94	140.18	2.0	0.750	0.750	8	5	16.58	50.74	129.81
1.8	0.750	0.625	9	5	18.42	79.56	177.56	2.0	0.750	0.750	9	5	16.53	43.11	114.85
1.8	0.750	0.625	10	5	18.25	71.39	161.88	2.0	0.750	0.750	10	5	16.68	38.77	106.77

PLATE AREA - 800.0000

MAXIMUM STRESSES															MAXIMUM STRESSES				
B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL				
2.0	0.875	0.625	8	5	13.69	87.60	183.30	4.0	0.625	0.750	12	3	13.93	44.26	86.52				
2.0	0.875	0.625	9	5	13.44	76.39	161.75	4.0	0.625	0.750	13	3	13.71	43.99	85.98				
2.0	0.875	0.625	10	5	13.24	68.68	147.01	4.0	0.625	0.750	14	3	13.86	43.75	85.51				
2.0	0.875	0.750	8	4	13.16	51.51	119.20	4.0	0.750	0.500	11	4	10.90	84.46	172.52				
2.0	0.875	0.750	9	4	13.00	45.03	106.45	4.0	0.750	0.500	12	4	10.68	77.71	159.73				
2.0	0.875	0.750	10	4	12.88	40.05	97.18	4.0	0.750	0.500	13	4	10.50	71.37	147.44				
2.0	0.875	0.750	8	5	12.63	51.05	118.34	4.0	0.750	0.500	14	4	10.34	66.42	138.06				
2.0	0.875	0.750	9	5	12.48	43.88	104.50												
2.0	0.875	0.750	10	5	12.36	39.44	96.11												
2.0	1.000	0.625	8	5	11.37	85.35	174.01												
2.0	1.000	0.625	9	5	11.09	75.27	154.68												
2.0	1.000	0.625	10	5	10.87	67.68	140.12												
2.0	1.000	0.750	8	4	10.62	51.11	111.64												
2.0	1.000	0.750	9	4	10.44	45.01	99.80												
2.0	1.000	0.750	10	4	10.31	40.08	90.52												
2.0	1.000	0.750	8	5	10.22	50.70	110.88												
2.0	1.000	0.750	9	5	10.05	44.05	98.12												
4.0	0.500	0.500	11	4	19.42	84.80	196.58												
4.0	0.500	0.500	12	4	19.26	96.60	187.83												
4.0	0.500	0.500	13	4	19.14	95.93	186.52												
4.0	0.500	0.500	14	4	19.03	95.36	185.40												
4.0	0.500	0.625	11	4	19.21	41.05	125.73												
4.0	0.500	0.625	12	4	19.94	37.92	121.41												
4.0	0.500	0.625	13	4	19.24	33.70	111.54												
4.0	0.500	0.625	14	4	19.75	31.39	108.31												
4.0	0.500	0.750	11	3	20.85	22.25	104.79												
4.0	0.500	0.750	12	3	21.20	20.11	101.62												
4.0	0.500	0.750	13	3	20.67	49.67	98.25												
4.0	0.500	0.750	14	3	20.88	49.48	97.87												
4.0	0.625	0.500	11	4	13.85	85.79	182.39												
4.0	0.625	0.500	12	4	13.66	79.02	169.79												
4.0	0.625	0.500	13	4	13.50	71.93	155.84												
4.0	0.625	0.500	14	4	13.37	77.50	150.35												
4.0	0.625	0.625	11	4	12.35	43.13	107.36												
4.0	0.625	0.625	12	4	12.76	39.78	101.68												
4.0	0.625	0.625	13	4	12.46	35.79	93.35												
4.0	0.625	0.625	14	4	12.75	47.54	92.54												
4.0	0.625	0.750	11	3	13.70	44.58	87.16												

PLATE AREA - B50.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.625	0.750	6	6	25.17	71.00	182.29	1.2	1.000	0.750	7	7	12.31	65.61	139.90
1.0	0.625	0.750	7	6	25.29	70.59	181.20	1.2	1.000	0.750	8	7	12.20	56.29	121.80
1.0	0.625	0.750	6	7	25.20	70.55	181.20								
1.0	0.625	0.750	7	7	25.23	59.74	163.03	1.4	0.625	0.750	7	5	29.19	66.42	188.93
1.0	0.750	0.750	6	6	18.08	71.18	163.34	1.4	0.625	0.750	8	5	29.11	57.36	170.72
1.0	0.750	0.750	7	6	18.11	70.67	162.15	1.4	0.625	0.750	9	5	29.04	69.49	160.66
1.0	0.750	0.750	6	7	18.02	70.67	162.15	1.4	0.625	0.750	7	6	29.01	66.32	188.58
1.0	0.750	0.750	7	7	18.01	60.82	144.82	1.4	0.625	0.750	8	6	28.93	57.26	170.36
1.0	0.875	0.750	6	6	13.90	70.22	151.65	1.4	0.625	0.750	9	6	28.86	49.01	159.36
1.0	0.875	0.750	7	6	13.87	69.61	150.29	1.4	0.750	0.625	9	6	21.28	90.35	199.53
1.0	0.875	0.750	6	7	13.77	69.61	150.29	1.4	0.750	0.750	7	5	20.90	68.35	166.90
1.0	0.875	0.750	7	7	13.73	60.76	134.37	1.4	0.750	0.750	8	5	20.78	58.89	148.28
1.0	1.000	0.750	6	6	11.25	68.57	142.95	1.4	0.750	0.750	9	5	20.69	68.05	146.36
1.0	1.000	0.750	7	6	11.18	67.81	141.33	1.4	0.750	0.750	7	6	20.71	68.11	166.29
1.0	1.000	0.750	6	7	11.08	67.81	141.33	1.4	0.750	0.750	8	6	20.60	58.72	147.79
1.0	1.000	0.750	7	7	11.01	59.97	127.02	1.4	0.875	0.750	9	6	20.51	50.93	133.41
								1.4	0.875	0.625	9	6	16.47	89.92	189.26
1.2	0.625	0.750	7	6	28.49	64.52	181.24	1.4	0.875	0.750	7	5	15.99	68.90	154.77
1.2	0.625	0.750	8	6	28.45	55.45	162.72	1.4	0.875	0.750	8	5	15.85	66.04	136.76
1.2	0.625	0.750	7	7	28.45	64.97	181.87	1.4	0.875	0.750	9	5	15.74	65.61	135.81
1.2	0.625	0.750	8	7	28.39	55.49	162.62	1.4	0.875	0.750	7	6	15.81	68.51	153.88
1.2	0.750	0.750	6	6	20.33	78.48	182.33	1.4	0.875	0.750	8	6	15.67	58.97	135.31
1.2	0.750	0.750	7	6	20.34	66.22	160.45	1.4	0.875	0.750	9	6	15.56	51.69	121.76
1.2	0.750	0.750	8	6	20.26	56.82	141.79	1.4	1.000	0.625	9	5	13.64	100.13	197.49
1.2	0.750	0.750	6	7	20.28	78.12	181.48	1.4	1.000	0.625	9	6	13.41	88.46	181.13
1.2	0.750	0.750	7	7	20.26	66.33	160.45	1.4	1.000	0.750	7	5	12.87	68.50	146.57
1.2	0.750	0.750	8	7	20.18	56.73	141.45	1.4	1.000	0.750	8	5	12.71	63.17	127.96
1.2	0.875	0.750	6	6	15.58	77.47	168.64	1.4	1.000	0.750	9	5	12.58	62.57	126.70
1.2	0.875	0.750	7	6	15.51	66.57	148.80	1.4	1.000	0.750	7	6	12.69	67.96	145.42
1.2	0.875	0.750	8	6	15.41	57.07	130.22	1.4	1.000	0.750	8	6	12.53	58.51	127.11
1.2	0.875	0.750	6	7	15.48	77.04	167.65	1.4	1.000	0.750	9	6	12.40	51.77	114.49
1.2	0.875	0.750	7	7	15.41	66.40	148.31								
1.2	0.875	0.750	8	7	15.31	56.85	129.64	1.6	0.625	0.750	7	5	28.14	65.89	188.30
1.2	1.000	0.625	6	6	13.38	95.74	194.26	1.6	0.625	0.750	8	5	28.02	57.20	171.27
1.2	1.000	0.625	8	7	13.19	94.81	192.33	1.6	0.625	0.750	9	5	27.94	48.62	155.11
1.2	1.000	0.750	6	6	12.56	75.63	158.49	1.6	0.625	0.750	7	6	27.99	65.74	187.92
1.2	1.000	0.750	7	6	12.44	66.00	140.78	1.6	0.625	0.750	8	6	27.88	57.13	171.00
1.2	1.000	0.750	8	6	12.32	56.63	122.60	1.6	0.625	0.750	9	6	27.79	48.53	154.83
1.2	1.000	0.750	6	7	12.43	75.08	157.29	1.6	0.750	0.625	9	6	20.58	89.50	198.13

PLATE AREA - 850.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	0.750	0.750	7	5	20.18	67.81	166.08	1.8	1.000	0.625	8	5	12.81	96.72	196.73
1.6	0.750	0.750	8	5	20.03	58.73	148.43	1.8	1.000	0.625	9	5	12.53	85.74	175.72
1.6	0.750	0.750	9	5	19.92	50.61	133.11	1.8	1.000	0.625	10	5	12.31	76.91	158.74
1.6	0.750	0.750	7	6	20.03	67.57	165.52	1.8	1.000	0.750	8	5	11.62	57.39	124.89
1.6	0.750	0.750	8	6	19.88	58.61	148.07	1.8	1.000	0.750	9	5	11.45	50.16	111.11
1.6	0.750	0.750	9	6	19.77	50.46	132.73	1.8	1.000	0.750	10	5	11.31	44.92	101.07
1.6	0.975	0.625	9	5	16.15	89.58	188.82	2.0	0.500	0.750	9	5	38.77	41.32	189.89
1.6	0.975	0.625	9	6	15.96	89.10	187.79	2.0	0.500	0.750	10	5	39.11	36.87	182.27
1.6	0.875	0.750	7	5	15.48	68.37	153.86	2.0	0.625	0.625	10	5	24.77	74.79	186.28
1.6	0.875	0.750	8	5	15.30	59.07	139.87	2.0	0.625	0.750	8	5	25.21	54.27	162.41
1.6	0.875	0.750	9	5	15.17	51.45	121.51	2.0	0.625	0.750	9	5	24.96	45.46	144.69
1.6	0.875	0.750	7	6	15.33	58.03	153.12	2.0	0.625	0.750	10	5	25.19	40.88	136.36
1.6	0.875	0.750	8	6	15.16	58.88	135.41	2.0	0.750	0.625	9	5	18.22	83.94	185.93
1.6	0.875	0.750	9	6	15.02	51.24	121.00	2.0	0.750	0.625	10	5	18.03	75.60	170.04
1.6	1.000	0.625	9	5	13.21	88.28	180.91	2.0	0.750	0.750	8	5	17.45	55.70	140.69
1.6	1.000	0.625	9	6	13.03	87.66	179.63	2.0	0.750	0.750	9	5	17.31	47.32	124.30
1.6	1.000	0.750	7	5	12.49	67.99	145.64	2.0	0.750	0.750	10	5	17.40	42.59	115.45
1.6	1.000	0.750	8	5	12.29	58.67	127.67	2.0	0.875	0.625	9	5	14.28	83.73	176.49
1.6	1.000	0.750	9	5	12.14	51.61	114.33	2.0	0.875	0.625	10	5	14.07	75.30	160.35
1.6	1.000	0.750	7	6	12.35	67.56	144.72	2.0	0.875	0.750	8	5	13.42	55.99	128.71
1.6	1.000	0.750	8	6	12.15	58.42	127.09	2.0	0.875	0.750	9	5	13.26	48.13	113.52
1.6	1.000	0.750	9	6	12.00	51.32	113.70	2.0	0.875	0.750	10	5	13.13	43.28	104.34
1.8	0.500	0.750	9	5	40.78	42.92	198.30	2.0	1.000	0.625	8	5	12.08	93.54	190.21
1.8	0.500	0.750	10	5	40.89	38.12	189.35	2.0	1.000	0.625	9	5	11.79	82.49	169.00
1.8	0.625	0.625	10	5	26.73	77.44	192.89	2.0	1.000	0.625	10	5	11.55	74.18	153.06
1.8	0.625	0.750	8	5	26.26	55.99	167.83	2.0	1.000	0.750	8	5	10.86	55.58	120.85
1.8	0.625	0.750	9	5	26.22	47.25	150.80	2.0	1.000	0.750	9	5	10.68	48.29	106.85
1.8	0.625	0.750	10	5	26.31	42.29	141.44	2.0	1.000	0.750	10	5	10.54	43.38	97.50
1.8	0.750	0.625	9	5	19.57	87.24	193.31	4.0	0.500	0.625	11	4	20.15	45.08	135.64
1.8	0.750	0.625	10	5	19.39	78.31	176.15	4.0	0.500	0.625	12	4	20.91	41.66	130.26
1.8	0.750	0.750	8	5	18.81	57.48	145.36	4.0	0.500	0.625	13	4	20.19	37.03	120.12
1.8	0.750	0.750	9	5	18.68	49.18	129.40	4.0	0.500	0.625	14	4	20.73	50.67	113.80
1.8	0.750	0.750	10	5	18.58	44.07	119.68	4.0	0.500	0.625	15	4	20.19	50.49	118.44
1.8	0.875	0.625	9	5	15.26	87.02	183.48	4.0	0.500	0.750	11	4	20.81	23.59	106.80
1.8	0.875	0.625	10	5	15.06	78.03	166.19	4.0	0.500	0.750	12	4	21.60	21.62	105.29
1.8	0.875	0.750	8	5	14.41	57.79	132.98	4.0	0.500	0.750	13	4	20.65	18.96	97.31
1.8	0.875	0.750	9	5	14.26	50.01	118.10	4.0	0.500	0.750	14	4	21.18	17.50	96.06
1.8	0.875	0.750	10	5	14.14	44.80	108.14								

PLATE AREA - 850.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
4.0	0.500	0.750	15	4	20.47	15.66	90.38
4.0	0.625	0.500	11	4	14.73	93.98	198.91
4.0	0.625	0.500	12	4	14.53	86.58	185.09
4.0	0.625	0.500	13	4	14.36	78.81	169.83
4.0	0.625	0.500	14	4	14.22	85.09	165.06
4.0	0.625	0.500	15	4	14.10	84.26	163.44
4.0	0.625	0.625	11	4	13.10	47.27	116.46
4.0	0.625	0.625	12	4	13.37	43.62	110.22
4.0	0.625	0.625	13	4	13.06	52.64	102.45
4.0	0.625	0.625	14	4	13.36	52.30	101.77
4.0	0.625	0.625	15	4	13.13	52.00	101.19
4.0	0.625	0.750	11	4	13.72	26.04	82.74
4.0	0.625	0.750	12	4	14.21	23.99	79.91
4.0	0.625	0.750	13	4	13.74	21.36	73.67
4.0	0.625	0.750	14	4	14.07	19.85	71.55
4.0	0.625	0.750	15	4	13.72	18.00	67.13
4.0	0.750	0.500	11	4	11.99	92.50	188.46
4.0	0.750	0.500	12	4	11.36	85.11	174.45
4.0	0.750	0.500	13	4	11.17	78.17	160.99
4.0	0.750	0.500	14	4	11.00	72.76	150.71
4.0	0.750	0.500	15	4	10.85	67.68	140.86

PLATE AREA - 900.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.625	0.750	6	6	26.62	77.64	196.66	1.4	0.625	0.750	8	6	30.61	62.65	182.87
1.0	0.625	0.750	7	6	26.76	77.14	195.44	1.4	0.625	0.750	9	6	30.54	53.64	166.44
1.0	0.625	0.750	6	7	26.66	77.14	195.44	1.4	0.750	0.750	7	5	22.12	74.60	180.20
1.0	0.625	0.750	7	7	26.70	65.35	175.47	1.4	0.750	0.750	8	5	21.99	64.33	159.99
1.0	0.750	0.750	6	6	19.12	77.76	176.94	1.4	0.750	0.750	9	5	21.90	74.39	159.12
1.0	0.750	0.750	7	6	19.16	77.20	175.63	1.4	0.750	0.750	7	6	21.92	74.36	179.58
1.0	0.750	0.750	6	7	19.06	77.20	175.63	1.4	0.750	0.750	8	6	21.80	64.14	159.47
1.0	0.750	0.750	7	7	19.06	66.44	156.62	1.4	0.750	0.750	9	6	21.70	55.63	143.74
1.0	0.875	0.625	8	8	15.19	96.41	198.39	1.4	0.875	0.750	7	5	16.93	75.16	167.63
1.0	0.875	0.750	6	6	14.71	76.67	164.67	1.4	0.875	0.750	8	5	16.78	72.16	148.91
1.0	0.875	0.750	7	6	14.68	76.00	163.17	1.4	0.875	0.750	9	5	16.66	71.69	147.89
1.0	0.875	0.750	6	7	14.58	76.00	163.17	1.4	0.875	0.750	7	6	16.73	74.74	166.70
1.0	0.875	0.750	7	7	14.54	66.34	145.73	1.4	0.875	0.750	8	6	16.58	64.37	146.49
1.0	1.000	0.625	8	8	12.37	93.56	188.75	1.4	0.875	0.750	9	6	16.47	56.42	131.67
1.0	1.000	0.750	6	6	11.90	74.84	155.44	1.4	1.000	0.625	9	6	14.19	96.47	196.98
1.0	1.000	0.750	7	6	11.83	74.01	153.67	1.4	1.000	0.750	7	5	13.62	74.70	159.07
1.0	1.000	0.750	6	7	11.73	74.01	153.67	1.4	1.000	0.750	8	5	13.45	69.01	139.46
1.0	1.000	0.750	7	7	11.66	65.45	138.01	1.4	1.000	0.750	9	6	13.43	74.13	157.84
1.2	0.625	0.750	7	6	30.15	70.53	194.79	1.4	1.000	0.750	8	6	13.26	63.83	137.90
1.2	0.625	0.750	8	6	30.09	60.67	174.72	1.4	1.000	0.750	9	6	13.13	56.48	124.11
1.2	0.625	0.750	7	7	30.10	71.06	195.55	1.6	0.625	0.750	8	5	29.66	62.58	183.84
1.2	0.625	0.750	8	7	30.04	60.73	174.64	1.6	0.625	0.750	9	5	29.56	53.20	166.16
1.2	0.750	0.750	7	6	21.52	72.31	173.32	1.6	0.625	0.750	8	6	29.50	62.50	183.57
1.2	0.750	0.750	8	6	21.44	62.08	153.05	1.6	0.625	0.750	9	6	29.41	53.11	165.90
1.2	0.750	0.750	7	7	21.44	72.44	173.37	1.6	0.750	0.625	10	6	21.62	87.42	194.98
1.2	0.750	0.750	8	7	21.35	61.99	152.70	1.6	0.750	0.750	7	5	21.36	74.01	179.31
1.2	0.875	0.750	7	6	16.42	72.64	161.24	1.6	0.750	0.750	8	5	21.20	64.15	160.14
1.2	0.875	0.750	8	6	16.31	62.30	141.02	1.6	0.750	0.750	9	5	21.08	55.27	143.39
1.2	0.875	0.750	7	7	16.30	72.47	160.74	1.6	0.750	0.750	8	6	21.05	73.76	178.74
1.2	0.875	0.750	8	7	16.20	62.06	140.41	1.6	0.750	0.750	9	6	21.05	64.01	159.77
1.2	1.000	0.750	7	6	13.17	72.06	152.85	1.6	0.750	0.750	8	6	20.93	55.12	143.01
1.2	1.000	0.750	8	6	13.04	61.80	133.05	1.6	0.875	0.625	10	6	16.71	86.98	184.27
1.2	1.000	0.750	7	7	13.03	71.59	151.91	1.6	0.875	0.750	7	5	16.38	74.58	166.64
1.2	1.000	0.750	8	7	12.91	61.42	132.18	1.6	0.875	0.750	8	5	16.20	64.46	147.07
1.4	0.625	0.750	8	5	30.80	62.75	183.24	1.6	0.875	0.750	9	5	16.05	56.15	131.37
1.4	0.625	0.750	9	5	30.73	76.00	174.16	1.6	0.875	0.750	7	6	16.23	74.21	165.86

PLATE AREA - 900.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	0.875	0.750	8	6	16.04	64.25	146.58	1.8	1.000	0.625	10	5	13.04	83.86	172.54
1.6	0.875	0.750	9	6	15.90	55.92	130.85	1.8	1.000	0.625	9	6	13.12	92.94	189.96
1.6	1.000	0.625	9	5	13.98	96.26	196.70	1.8	1.000	0.625	10	6	12.89	83.48	171.76
1.6	1.000	0.625	10	5	13.77	93.77	184.28	1.8	1.000	0.750	8	5	12.30	62.60	135.47
1.6	1.000	0.625	9	6	13.80	95.58	195.32	1.8	1.000	0.750	9	5	12.12	54.71	120.43
1.6	1.000	0.625	10	6	13.59	85.64	176.15	1.8	1.000	0.750	10	5	11.98	49.00	109.49
1.6	1.000	0.750	7	5	13.22	74.14	158.05	1.8	1.000	0.750	8	6	12.18	62.40	135.04
1.6	1.000	0.750	8	5	13.01	64.00	138.50	1.8	1.000	0.750	9	6	12.00	54.45	119.87
1.6	1.000	0.750	9	5	12.85	56.29	123.91	1.8	1.000	0.750	9	6	11.86	48.83	109.11
1.6	1.000	0.750	7	6	13.07	73.67	157.07								
1.6	1.000	0.750	8	6	12.86	63.72	137.87	2.0	0.500	0.750	10	5	40.73	40.58	193.84
1.6	1.000	0.750	9	6	12.70	55.99	123.24	2.0	0.500	0.750	11	5	40.22	34.66	180.88
								2.0	0.625	0.625	11	5	26.09	92.24	186.51
1.8	0.625	0.750	8	5	27.79	61.24	180.19	2.0	0.625	0.750	8	5	26.22	59.35	174.42
1.8	0.625	0.750	9	5	27.69	51.69	161.60	2.0	0.625	0.750	9	5	25.96	49.73	155.12
1.8	0.625	0.750	10	5	27.60	46.31	151.43	2.0	0.625	0.750	10	5	26.20	44.75	146.06
1.8	0.625	0.750	8	6	27.66	61.17	179.98	2.0	0.625	0.750	11	5	25.99	38.94	134.26
1.8	0.625	0.750	9	6	27.55	51.57	161.32	2.0	0.750	0.625	10	5	19.10	82.48	184.19
1.8	0.625	0.750	10	6	27.47	46.24	151.24	2.0	0.750	0.625	11	5	18.93	86.60	171.94
1.8	0.750	0.625	10	5	20.53	96.24	192.00	2.0	0.750	0.750	8	5	18.48	60.82	151.84
1.8	0.750	0.625	10	6	20.36	85.24	190.34	2.0	0.750	0.750	9	5	18.33	51.67	133.96
1.8	0.750	0.750	8	5	19.92	62.77	156.85	2.0	0.750	0.750	10	5	18.21	46.53	124.33
1.8	0.750	0.750	9	5	19.78	53.70	139.42	2.0	0.750	0.750	11	5	18.12	40.91	113.28
1.8	0.750	0.750	10	5	19.67	48.16	128.85	2.0	0.875	0.625	9	5	15.12	91.29	191.64
1.8	0.750	0.750	8	6	19.79	62.66	156.58	2.0	0.875	0.625	10	5	14.90	82.12	174.07
1.8	0.750	0.750	9	6	19.65	53.54	139.06	2.0	0.875	0.625	11	5	14.71	80.17	157.68
1.8	0.750	0.750	10	6	19.54	48.06	128.60	2.0	0.875	0.750	8	5	14.21	61.09	139.34
1.8	0.875	0.625	9	5	16.16	85.10	199.24	2.0	0.875	0.750	9	5	14.04	52.51	122.77
1.8	0.875	0.625	10	5	15.95	85.10	180.41	2.0	0.875	0.750	10	5	13.90	47.23	112.77
1.8	0.875	0.625	9	6	16.00	94.45	198.34	2.0	0.875	0.750	11	5	13.80	41.87	102.37
1.8	0.875	0.625	10	6	15.79	84.81	179.78	2.0	1.000	0.625	9	5	12.48	89.93	183.74
1.8	0.875	0.625	8	5	15.26	63.06	143.95	2.0	1.000	0.625	10	5	12.23	80.88	166.36
1.8	0.875	0.750	9	5	15.10	54.56	127.71	2.0	1.000	0.625	11	5	12.03	72.93	151.10
1.8	0.875	0.750	10	5	14.97	48.90	116.86	2.0	1.000	0.750	8	5	11.50	60.62	131.10
1.8	0.875	0.750	8	6	15.14	62.91	143.60	2.0	1.000	0.750	9	5	11.31	52.66	115.82
1.8	0.875	0.750	9	6	14.98	54.35	127.24	2.0	1.000	0.750	10	5	11.16	47.32	105.64
1.8	0.875	0.750	10	6	14.85	48.77	116.55	2.0	1.000	0.750	11	5	11.04	42.25	95.87
1.8	1.000	0.625	9	5	13.27	93.48	191.04								

PLATE AREA - 900.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
4.0	0.500	0.625	11	4	21.05	49.24	145.72
4.0	0.500	0.625	12	4	21.85	45.53	140.47
4.0	0.500	0.625	13	4	21.10	66.60	130.35
4.0	0.500	0.625	14	4	21.67	66.37	129.90
4.0	0.500	0.625	15	4	21.11	66.18	129.52
4.0	0.500	0.750	11	4	21.95	25.83	114.25
4.0	0.500	0.750	12	4	22.80	23.69	112.57
4.0	0.500	0.750	13	4	21.80	20.78	104.00
4.0	0.500	0.750	14	4	22.38	19.20	102.63
4.0	0.500	0.750	15	4	21.63	17.19	96.92
4.0	0.625	0.500	13	4	15.22	85.90	184.19
4.0	0.625	0.500	14	4	15.07	92.91	180.23
4.0	0.625	0.500	15	4	14.94	92.00	178.47
4.0	0.625	0.625	11	4	13.89	51.55	125.77
4.0	0.625	0.625	12	4	13.96	47.58	118.96
4.0	0.625	0.625	13	4	13.69	57.57	112.02
4.0	0.625	0.625	14	4	13.96	57.20	111.29
4.0	0.625	0.625	15	4	13.71	56.88	110.67
4.0	0.625	0.750	11	4	14.44	28.43	88.93
4.0	0.625	0.750	12	4	14.96	26.20	85.82
4.0	0.625	0.750	13	4	14.46	23.33	79.07
4.0	0.625	0.750	14	4	14.82	21.69	76.75
4.0	0.625	0.750	15	4	14.45	19.68	71.97
4.0	0.750	0.500	12	4	12.04	92.74	189.59
4.0	0.750	0.500	13	4	11.83	85.18	174.92
4.0	0.750	0.500	14	4	11.65	79.28	163.72
4.0	0.750	0.500	15	4	11.50	73.75	152.99
4.0	0.750	0.625	11	4	10.52	52.33	116.16
4.0	0.750	0.625	12	4	10.39	48.19	108.58
4.0	0.750	0.625	13	4	10.28	43.77	99.82
4.0	0.750	0.625	14	4	10.18	40.75	94.29
4.0	0.750	0.625	15	4	10.10	48.10	93.34
4.0	0.750	0.750	11	4	10.08	29.69	77.24
4.0	0.750	0.750	12	4	10.41	27.34	73.35
4.0	0.750	0.750	13	4	10.16	24.60	67.94
4.0	0.750	0.750	14	4	10.40	22.89	64.68
4.0	0.750	0.750	15	4	10.22	31.96	62.26
4.0	0.875	0.500	11	4	10.32	97.05	193.59
4.0	0.875	0.500	12	4	10.05	89.42	179.01

PLATE AREA - 950.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.625	0.750	7	7	28.17	71.13	188.20	1.2	0.875	0.750	8	6	17.21	67.69	152.10
1.0	0.625	0.750	8	7	28.14	71.11	187.98	1.2	0.875	0.750	7	7	17.20	78.72	173.49
1.0	0.625	0.750	7	8	28.07	71.11	187.98	1.2	0.875	0.750	8	7	17.09	67.43	151.45
1.0	0.625	0.750	8	8	28.04	60.38	166.23	1.2	1.000	0.750	7	6	13.90	78.18	165.25
1.0	0.750	0.750	6	6	20.17	84.54	190.88	1.2	1.000	0.750	8	6	13.76	67.12	143.78
1.0	0.750	0.750	7	6	20.21	83.91	189.45	1.2	1.000	0.750	7	7	13.75	77.74	164.24
1.0	0.750	0.750	8	6	20.17	83.59	188.67	1.2	1.000	0.750	8	7	13.63	66.71	142.85
1.0	0.750	0.750	6	7	20.11	83.91	189.45								
1.0	0.750	0.750	7	7	20.11	72.23	168.71	1.4	0.625	0.750	8	5	32.49	68.31	196.02
1.0	0.750	0.750	8	7	20.06	72.04	168.18	1.4	0.625	0.750	9	5	32.41	82.72	188.02
1.0	0.750	0.750	6	8	19.99	83.59	188.67	1.4	0.625	0.750	8	6	32.29	68.21	195.64
1.0	0.750	0.750	7	8	19.99	72.04	168.18	1.4	0.625	0.750	9	6	32.21	58.42	177.73
1.0	0.750	0.750	8	8	19.93	61.33	146.98	1.4	0.750	0.750	7	5	23.33	81.03	193.81
1.0	0.875	0.750	6	6	15.51	83.31	178.03	1.4	0.750	0.750	8	5	23.20	81.25	173.02
1.0	0.875	0.750	7	6	15.49	82.57	176.41	1.4	0.750	0.750	9	5	23.10	80.91	172.23
1.0	0.875	0.750	8	6	15.42	82.11	175.38	1.4	0.750	0.750	7	6	23.13	80.79	193.19
1.0	0.875	0.750	6	7	15.38	82.57	176.41	1.4	0.750	0.750	8	6	23.00	69.72	171.43
1.0	0.875	0.750	7	7	15.34	72.08	157.40	1.4	0.750	0.750	9	6	22.90	60.48	154.30
1.0	0.875	0.750	8	7	15.27	71.72	156.56	1.4	0.875	0.750	7	5	17.86	81.59	180.83
1.0	0.875	0.750	6	8	15.24	82.11	175.38	1.4	0.875	0.750	8	5	17.70	78.46	161.41
1.0	0.875	0.750	7	8	15.20	71.72	156.56	1.4	0.875	0.750	9	5	17.58	77.95	160.31
1.0	0.875	0.750	8	8	15.13	61.20	135.99	1.4	0.875	0.750	7	6	17.65	81.16	179.85
1.0	1.000	0.750	6	6	12.55	81.29	168.27	1.4	0.875	0.750	8	6	17.50	69.92	157.96
1.0	1.000	0.750	7	6	12.48	80.39	166.35	1.4	0.875	0.750	9	6	17.37	61.29	141.83
1.0	1.000	0.750	8	6	12.40	79.77	163.02	1.4	1.000	0.750	7	5	14.38	81.08	171.91
1.0	1.000	0.750	6	7	12.37	80.39	166.35	1.4	1.000	0.750	8	5	14.19	75.02	151.29
1.0	1.000	0.750	7	7	12.30	71.10	149.30	1.4	1.000	0.750	9	5	14.05	74.31	149.82
1.0	1.000	0.750	8	7	12.22	70.57	148.15	1.4	1.000	0.750	7	6	14.17	80.47	170.60
1.0	1.000	0.750	6	8	12.31	79.77	163.02	1.4	1.000	0.750	8	6	13.99	69.31	148.99
1.0	1.000	0.750	7	8	12.14	70.57	148.15	1.4	1.000	0.750	9	6	13.85	61.32	133.98
1.0	1.000	0.750	8	8	12.07	60.41	128.44								
								1.6	0.625	0.750	8	5	31.29	68.12	196.66
1.2	0.625	0.750	8	6	31.74	66.06	186.98	1.6	0.625	0.750	9	5	31.19	57.92	177.42
1.2	0.625	0.750	8	7	31.69	66.13	186.91	1.6	0.625	0.750	10	5	31.12	51.72	165.33
1.2	0.750	0.750	7	6	22.70	78.57	186.50	1.6	0.625	0.750	8	6	31.13	68.03	196.38
1.2	0.750	0.750	8	6	22.61	67.49	164.57	1.6	0.625	0.750	9	6	31.03	57.84	177.17
1.2	0.750	0.750	7	7	22.62	78.73	186.61	1.6	0.625	0.750	10	6	30.96	51.66	165.11
1.2	0.750	0.750	8	7	22.53	67.40	164.21	1.6	0.750	0.750	8	5	22.37	69.72	172.13
1.2	0.875	0.750	7	6	17.32	78.89	174.01	1.6	0.750	0.750	9	5	22.24	60.07	153.90

PLATE AREA - 950.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	0.750	0.750	10	5	22.15	70.42	147.88	1.8	1.000	0.625	10	5	13.76	91.01	186.73
1.6	0.750	0.750	8	6	22.21	69.58	171.74	1.8	1.000	0.625	10	6	13.61	90.61	185.88
1.6	0.750	0.750	9	6	22.08	59.92	153.51	1.8	1.000	0.750	8	5	12.98	67.95	146.34
1.6	0.750	0.750	10	6	21.98	53.58	141.22	1.8	1.000	0.750	9	5	12.79	59.39	129.99
1.6	0.875	0.625	10	6	17.63	94.43	199.21	1.8	1.000	0.750	10	5	12.64	53.20	118.13
1.6	0.875	0.750	8	5	17.09	70.01	158.57	1.8	1.000	0.750	8	6	12.86	67.74	145.87
1.6	0.875	0.750	9	5	16.94	60.98	141.48	1.8	1.000	0.750	9	6	12.67	59.11	129.40
1.6	0.875	0.750	10	5	16.82	67.54	137.67	1.8	1.000	0.750	10	6	12.52	53.02	117.73
1.6	0.875	0.750	8	6	16.93	69.79	158.04								
1.6	0.875	0.750	9	6	16.78	60.74	140.93	2.0	0.500	0.750	11	5	41.79	37.98	191.51
1.6	0.875	0.750	10	6	16.67	54.31	128.50	2.0	0.625	0.750	8	5	27.19	64.59	186.66
1.6	1.000	0.625	10	6	14.34	92.96	190.65	2.0	0.625	0.750	9	5	27.01	54.13	165.73
1.6	1.000	0.750	8	5	13.73	69.49	149.61	2.0	0.625	0.750	10	5	27.18	48.75	155.91
1.6	1.000	0.750	9	5	13.56	61.11	133.74	2.0	0.625	0.750	11	5	26.97	42.43	143.13
1.6	1.000	0.750	10	5	13.42	64.08	128.42	2.0	0.750	0.625	10	5	20.16	89.56	198.71
1.6	1.000	0.750	8	6	13.58	69.19	148.93	2.0	0.750	0.625	11	5	19.99	94.19	186.77
1.6	1.000	0.750	9	6	13.41	60.79	133.04	2.0	0.750	0.750	8	5	19.50	66.09	163.24
1.6	1.000	0.750	10	6	13.27	54.35	120.63	2.0	0.750	0.750	9	5	19.35	56.15	143.82
								2.0	0.750	0.750	10	5	19.23	50.58	133.39
1.8	0.625	0.750	8	5	29.33	66.65	192.79	2.0	0.750	0.750	11	5	19.13	44.48	121.40
1.8	0.625	0.750	9	5	29.21	56.27	172.60	2.0	0.875	0.625	10	5	15.72	89.13	188.15
1.8	0.625	0.750	10	5	29.13	50.45	161.59	2.0	0.875	0.625	11	5	15.53	87.17	171.33
1.8	0.625	0.750	8	6	29.19	66.58	192.58	2.0	0.875	0.750	8	5	15.00	66.33	150.24
1.8	0.625	0.750	9	6	29.07	56.16	172.32	2.0	0.875	0.750	9	5	14.82	57.02	132.24
1.8	0.625	0.750	10	6	28.99	50.39	161.39	2.0	0.875	0.750	10	5	14.68	51.30	121.40
1.8	0.750	0.750	8	5	21.02	68.22	168.60	2.0	0.875	0.750	11	5	14.56	45.48	110.11
1.8	0.750	0.750	9	5	20.87	58.36	149.66	2.0	1.000	0.625	9	5	13.18	97.58	198.88
1.8	0.750	0.750	10	5	20.76	52.36	138.21	2.0	1.000	0.625	10	5	12.92	87.77	180.04
1.8	0.750	0.750	8	6	20.88	68.10	168.32	2.0	1.000	0.625	11	5	12.70	79.15	163.46
1.8	0.750	0.750	9	6	20.74	58.20	149.29	2.0	1.000	0.750	8	5	12.14	65.80	141.62
1.8	0.750	0.750	10	6	20.62	52.26	137.96	2.0	1.000	0.750	9	5	11.94	57.16	125.02
1.8	0.875	0.625	10	5	16.83	92.38	195.01	2.0	1.000	0.750	10	5	11.78	51.37	113.98
1.8	0.875	0.625	10	6	16.67	92.06	194.34	2.0	1.000	0.750	11	5	11.65	45.87	103.08
1.8	0.875	0.750	8	5	16.10	68.48	155.20								
1.8	0.875	0.750	9	5	15.93	59.25	137.54	4.0	0.500	0.625	11	4	21.92	53.52	155.97
1.8	0.875	0.750	10	5	15.80	53.12	125.79	4.0	0.500	0.625	12	4	22.76	49.92	150.23
1.8	0.875	0.750	8	6	15.97	68.33	154.83	4.0	0.500	0.625	13	4	21.97	72.48	141.81
1.8	0.875	0.750	9	6	15.81	59.03	137.05	4.0	0.500	0.625	14	4	22.57	72.25	141.34
1.8	0.875	0.750	10	6	15.67	52.98	125.47	4.0	0.500	0.625	15	4	22.00	72.04	140.93

PLATE AREA - 950.0000

MAXIMUM STRESSES

E/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
4.0	0.500	0.750	11	4	23.06	28.15	121.74
4.0	0.500	0.750	12	4	23.96	25.84	119.89
4.0	0.500	0.750	13	4	22.92	22.67	110.70
4.0	0.500	0.750	14	4	23.54	20.97	109.20
4.0	0.500	0.750	15	4	22.76	18.77	102.67
4.0	0.625	0.500	13	4	16.07	93.19	198.93
4.0	0.625	0.500	14	4	15.91	100.95	195.83
4.0	0.625	0.500	15	4	15.78	99.98	193.93
4.0	0.625	0.500	16	4	15.66	99.12	192.26
4.0	0.625	0.625	11	4	14.68	55.95	135.29
4.0	0.625	0.625	12	4	14.56	51.64	127.89
4.0	0.625	0.625	13	4	14.47	62.64	121.87
4.0	0.625	0.625	14	4	14.53	62.24	121.09
4.0	0.625	0.625	15	4	14.32	61.90	120.42
4.0	0.625	0.750	11	4	15.14	30.89	95.20
4.0	0.625	0.750	12	4	15.69	28.48	91.81
4.0	0.625	0.750	13	4	15.17	25.36	84.53
4.0	0.625	0.750	14	4	15.55	23.59	82.00
4.0	0.625	0.750	15	4	15.16	39.56	77.49
4.0	0.750	0.500	13	4	12.49	92.38	189.22
4.0	0.750	0.500	14	4	12.31	86.00	177.08
4.0	0.750	0.500	15	4	12.15	79.99	165.44
4.0	0.750	0.500	16	4	12.00	75.11	156.14
4.0	0.750	0.625	11	4	11.11	56.77	125.32
4.0	0.750	0.625	12	4	10.97	52.28	117.09
4.0	0.750	0.625	13	4	10.86	47.49	107.59
4.0	0.750	0.625	14	4	10.76	52.82	102.51
4.0	0.750	0.625	15	4	10.68	52.33	101.55
4.0	0.750	0.750	11	4	10.56	32.21	83.00
4.0	0.750	0.750	12	4	10.91	29.68	78.77
4.0	0.750	0.750	13	4	10.65	26.70	72.49
4.0	0.750	0.750	14	4	10.89	24.86	69.38
4.0	0.750	0.750	15	4	10.70	34.84	67.85
4.0	0.875	0.500	12	4	10.61	96.97	193.86
4.0	0.875	0.500	13	4	10.38	89.71	179.85
4.0	0.875	0.500	14	4	10.17	83.59	168.14

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MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.0	0.625	0.750	8	8	29.50	65.46	177.53	1.2	0.875	0.750	9	7	17.89	64.53	147.14
1.0	0.750	0.750	7	7	21.16	78.19	181.09	1.2	1.000	0.750	7	6	14.62	84.53	177.96
1.0	0.750	0.750	8	7	21.11	77.99	180.54	1.2	1.000	0.750	8	6	14.48	72.58	154.78
1.0	0.750	0.750	7	8	21.03	77.99	180.54	1.2	1.000	0.750	9	6	14.37	73.62	150.78
1.0	0.750	0.750	8	8	20.98	66.40	157.65	1.2	1.000	0.750	7	7	14.48	84.06	176.90
1.0	0.875	0.750	6	6	16.32	90.13	191.74	1.2	1.000	0.750	8	7	14.34	72.15	153.79
1.0	0.875	0.750	7	6	16.30	89.33	189.99	1.2	1.000	0.750	9	7	14.23	64.34	139.21
1.0	0.875	0.750	8	6	16.22	88.83	188.88								
1.0	0.875	0.750	6	7	16.18	89.33	189.99	1.4	0.625	0.750	9	6	33.89	63.33	189.24
1.0	0.875	0.750	7	7	16.14	77.99	169.36	1.4	0.625	0.750	9	7	33.85	63.62	189.61
1.0	0.875	0.750	8	7	16.07	77.60	168.47	1.4	0.750	0.750	8	6	24.20	75.47	183.66
1.0	0.875	0.750	6	8	16.03	88.83	188.88	1.4	0.750	0.750	9	6	24.09	65.47	165.10
1.0	0.875	0.750	7	8	15.99	77.60	168.47	1.4	0.750	0.750	8	7	24.13	75.39	183.39
1.0	0.875	0.750	8	8	15.92	66.23	146.24	1.4	0.750	0.750	9	7	24.03	65.56	165.11
1.0	1.000	0.750	6	6	13.21	87.93	181.45	1.4	0.875	0.750	7	6	18.58	87.76	193.32
1.0	1.000	0.750	7	6	13.13	86.95	179.38	1.4	0.875	0.750	8	6	18.41	75.63	169.70
1.0	1.000	0.750	8	6	13.05	86.28	177.94	1.4	0.875	0.750	9	6	18.28	66.30	152.23
1.0	1.000	0.750	6	7	13.02	86.95	179.38	1.4	0.875	0.750	7	7	18.49	87.59	192.86
1.0	1.000	0.750	7	7	12.95	76.90	160.89	1.4	0.875	0.750	8	7	18.32	75.44	169.22
1.0	1.000	0.750	8	7	12.86	76.33	159.65	1.4	0.875	0.750	9	7	18.19	66.21	151.93
1.0	1.000	0.750	6	8	12.85	86.28	177.95	1.4	1.000	0.750	7	6	14.91	86.99	183.68
1.0	1.000	0.750	7	8	12.78	76.33	159.65	1.4	1.000	0.750	8	6	14.72	74.95	160.35
1.0	1.000	0.750	8	8	12.70	65.36	138.35	1.4	1.000	0.750	9	6	14.58	66.31	144.10
								1.4	1.000	0.750	7	7	14.81	86.61	182.85
1.2	0.625	0.750	8	6	33.39	71.60	199.48	1.4	1.000	0.750	8	7	14.62	74.64	159.65
1.2	0.625	0.750	9	6	33.34	78.19	188.36	1.4	1.000	0.750	9	7	14.48	66.07	143.53
1.2	0.625	0.750	8	7	33.34	71.69	199.43								
1.2	0.625	0.750	9	7	33.29	62.17	182.43	1.6	0.625	0.750	9	5	32.82	62.77	188.88
1.2	0.750	0.750	7	6	23.88	85.00	200.00	1.6	0.625	0.750	10	5	32.74	56.09	175.86
1.2	0.750	0.750	8	6	23.79	73.06	176.37	1.6	0.625	0.750	9	6	32.65	62.70	188.64
1.2	0.750	0.750	9	6	23.72	77.70	171.37	1.6	0.625	0.750	10	6	32.57	56.04	175.64
1.2	0.750	0.750	8	7	23.70	72.96	175.99	1.6	0.750	0.750	8	5	23.54	75.45	184.39
1.2	0.750	0.750	9	7	23.63	63.96	159.51	1.6	0.750	0.750	9	5	23.41	65.00	164.64
1.2	0.875	0.750	7	6	18.22	85.32	187.09	1.6	0.750	0.750	10	5	23.30	76.29	159.59
1.2	0.875	0.750	8	6	18.10	73.22	163.45	1.6	0.750	0.750	8	6	23.37	75.30	183.98
1.2	0.875	0.750	9	6	18.01	76.04	160.00	1.6	0.750	0.750	9	6	23.24	64.85	164.25
1.2	0.875	0.750	7	7	18.10	85.14	186.56	1.6	0.750	0.750	10	6	23.13	58.01	150.99
1.2	0.875	0.750	8	7	17.99	72.95	162.76	1.6	0.875	0.750	8	5	17.99	75.71	170.33

PLATE AREA - 1000.0000

MAXIMUM STRESSES

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL	B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
1.6	0.875	0.750	9	5	17.83	65.94	151.83	1.8	1.000	0.750	8	5	13.66	73.46	157.47
1.6	0.875	0.750	10	5	17.70	73.15	148.74	1.8	1.000	0.750	9	5	13.46	64.19	139.78
1.6	0.875	0.750	8	6	17.82	75.48	169.78	1.8	1.000	0.750	10	5	13.31	57.52	126.98
1.6	0.875	0.750	9	6	17.66	65.69	151.26	1.8	1.000	0.750	11	5	13.18	61.02	121.45
1.6	0.875	0.750	10	6	17.54	58.75	137.84	1.8	1.000	0.750	8	6	13.53	73.23	156.97
1.6	1.000	0.750	8	5	14.45	75.12	160.99	1.8	1.000	0.750	9	6	13.34	63.90	139.15
1.6	1.000	0.750	9	5	14.27	66.06	143.82	1.8	1.000	0.750	10	6	13.18	57.33	126.55
1.6	1.000	0.750	10	5	14.13	69.39	138.83	1.8	1.000	0.750	11	6	13.05	51.33	115.06
1.6	1.000	0.750	8	6	14.29	74.80	160.28								
1.6	1.000	0.750	9	6	14.11	65.72	143.07	2.0	0.625	0.750	9	5	28.43	58.66	176.53
1.6	1.000	0.750	10	6	13.97	58.77	129.67	2.0	0.625	0.750	10	5	28.32	52.86	165.92
								2.0	0.625	0.750	11	5	28.24	46.03	152.13
1.8	0.625	0.750	9	5	30.74	60.98	183.79	2.0	0.625	0.750	9	6	28.29	58.52	176.22
1.8	0.625	0.750	10	5	30.65	54.71	171.92	2.0	0.625	0.750	10	6	28.19	52.79	165.74
1.8	0.625	0.750	11	5	30.58	47.85	158.46	2.0	0.625	0.750	11	6	28.11	45.93	151.90
1.8	0.625	0.750	9	6	30.60	60.87	183.51	2.0	0.750	0.625	11	6	20.87	85.74	192.04
1.8	0.625	0.750	10	6	30.50	54.65	171.72	2.0	0.750	0.750	9	5	20.37	60.76	153.90
1.8	0.625	0.750	11	6	30.43	47.78	158.25	2.0	0.750	0.750	10	5	20.24	54.76	142.64
1.8	0.750	0.625	11	6	22.45	89.20	199.75	2.0	0.750	0.750	11	5	20.13	48.16	129.68
1.8	0.750	0.750	8	5	22.12	73.82	180.62	2.0	0.750	0.750	9	6	20.24	60.58	153.50
1.8	0.750	0.750	9	5	21.97	63.15	160.12	2.0	0.750	0.750	10	6	20.11	54.66	142.41
1.8	0.750	0.750	10	5	21.85	56.69	147.77	2.0	0.750	0.750	11	6	20.01	48.03	129.38
1.8	0.750	0.750	11	5	21.75	67.76	140.07	2.0	0.875	0.625	11	5	16.35	94.38	185.36
1.8	0.750	0.750	8	6	21.98	73.70	180.32	2.0	0.875	0.625	11	6	16.20	85.90	182.42
1.8	0.750	0.750	9	6	21.82	62.99	159.74	2.0	0.875	0.750	9	5	15.60	61.65	141.93
1.8	0.750	0.750	10	6	21.71	56.59	147.51	2.0	0.875	0.750	10	5	15.45	55.49	130.23
1.8	0.750	0.750	11	6	21.61	49.95	134.70	2.0	0.875	0.750	11	5	15.33	49.19	118.02
1.8	0.875	0.625	11	6	17.35	89.33	189.72	2.0	0.875	0.750	9	6	15.48	61.42	141.44
1.8	0.875	0.750	8	5	16.95	74.06	166.72	2.0	0.875	0.750	10	6	15.33	55.36	129.94
1.8	0.875	0.750	9	5	16.77	64.07	147.61	2.0	0.875	0.750	11	6	15.21	49.02	117.65
1.8	0.875	0.750	10	5	16.63	57.46	134.93	2.0	1.000	0.625	10	5	13.60	94.85	194.06
1.8	0.875	0.750	11	5	16.52	64.66	130.46	2.0	1.000	0.625	11	5	13.37	85.53	176.14
1.8	0.875	0.750	8	6	16.81	73.89	166.32	2.0	1.000	0.625	10	6	13.46	94.51	193.38
1.8	0.875	0.750	9	6	16.64	63.84	147.10	2.0	1.000	0.625	11	6	13.24	85.13	175.34
1.8	0.875	0.750	10	6	16.50	57.31	134.59	2.0	1.000	0.750	9	5	12.57	61.78	134.44
1.8	0.875	0.750	11	6	16.38	50.97	122.42	2.0	1.000	0.750	10	5	12.40	55.54	122.53
1.8	1.000	0.625	11	5	14.28	96.36	188.69	2.0	1.000	0.750	11	5	12.27	49.58	111.06
1.8	1.000	0.625	11	6	14.12	88.52	182.35	2.0	1.000	0.750	9	6	12.46	61.51	133.87

PLATE AREA - 1000.0000

MAXIMUM STRESSES

B/A	H	DB	NB	NA	PLATE	BOLT AXIAL	BOLT TOTAL
2.0	1.000	0.750	10	6	12.29	55.38	122.19
2.0	1.000	0.750	11	6	12.16	49.38	110.62
4.0	0.500	0.625	12	4	23.64	53.62	160.15
4.0	0.500	0.625	13	4	22.82	78.53	153.59
4.0	0.500	0.625	14	4	23.45	78.28	153.09
4.0	0.500	0.625	15	4	22.85	78.06	152.65
4.0	0.500	0.625	16	4	23.32	77.87	152.27
4.0	0.500	0.750	12	4	25.09	28.05	127.24
4.0	0.500	0.750	13	4	24.01	24.63	117.43
4.0	0.500	0.750	14	4	24.66	22.79	115.79
4.0	0.500	0.750	15	4	23.86	20.41	108.82
4.0	0.500	0.750	16	4	24.33	19.00	107.45
4.0	0.625	0.625	12	4	15.35	55.85	137.00
4.0	0.625	0.625	13	4	15.25	67.85	132.00
4.0	0.625	0.625	14	4	15.16	67.43	131.17
4.0	0.625	0.625	15	4	15.09	67.06	130.45
4.0	0.625	0.625	16	4	15.08	66.74	129.82
4.0	0.625	0.750	12	4	16.39	30.83	97.88
4.0	0.625	0.750	13	4	15.85	27.45	90.06
4.0	0.625	0.750	14	4	16.25	25.55	87.32
4.0	0.625	0.750	15	4	15.85	42.93	84.06
4.0	0.625	0.750	16	4	16.14	42.79	83.78
4.0	0.750	0.500	14	4	12.96	92.89	190.77
4.0	0.750	0.500	15	4	12.79	86.40	178.20
4.0	0.750	0.500	16	4	12.64	81.13	168.16
4.0	0.750	0.625	12	4	11.56	56.48	125.80
4.0	0.750	0.625	13	4	11.44	51.31	115.54
4.0	0.750	0.625	14	4	11.34	57.20	111.02
4.0	0.750	0.625	15	4	11.25	56.68	109.99
4.0	0.750	0.625	16	4	11.17	56.22	109.09
4.0	0.750	0.750	12	4	11.39	32.08	84.29
4.0	0.750	0.750	13	4	11.12	28.87	77.52
4.0	0.750	0.750	14	4	11.37	26.88	74.16
4.0	0.750	0.750	15	4	11.18	37.80	73.60
4.0	0.750	0.750	16	4	11.37	37.59	73.20
4.0	0.875	0.500	13	4	10.93	96.89	193.95
4.0	0.875	0.500	14	4	10.71	90.28	181.31
4.0	0.875	0.500	15	4	10.52	84.44	170.04
4.0	0.875	0.500	16	4	10.36	79.35	160.30

APPENDIX C

Material Qualification Procedure for Glasses and Ceramics

1.0 Scope

This procedure establishes criteria for selection of glasses and ceramics suited for service as windows in explosion proof enclosures located in underground mines.

2.0 Applicable Documents

- 2.1 ANSI/ASTM-C-598, Annealing Point and Strain Point of Glass by Beam Bending
- 2.2 ANSI/ASTM-C-158, Flexure Testing of Glass (Determination of Modulus of Rupture).
- 2.3 ASTM-C-773, Compressive (Crushing) Strength of Fired Whiteware Materials.

3.0 Significance

- 3.1 The annealing point of the glass must be sufficiently higher than the design temperature of the window to prevent plastic deformation of window when it is subjected to design pressure.
- 3.2 The tensile and compressive strengths of glass must exceed by an adequate margin the stresses generated in the window by design pressure.
- 3.3 The glass must exhibit sufficient resistance to chemical attack by water present in mines to prevent unacceptable decrease in structural properties of the window.
- 3.4 The glass must possess the proper combination of tensile strength and linear coefficient of thermal expansion to prevent the thermal shock, generated by momentary immersion of the hot enclosure in water, from fracturing the window.

4.0 Test Procedures

- 4.1 The annealing point shall be determined by ANSI/ASTM-C-598, Standard Test Method For Annealing Point and Strain Point of Glass By Beam Bending. One test specimen shall be used.

- 4.2 The modulus of rupture shall be determined by ANSI/ASTM-C-158, Standard Test Method For Flexure Testing of Glass, Method A. Thirty test specimens with polished surfaces and edges shall be used.
- 4.3 The compressive strength shall be determined by ANSI/ASTM-C-773, Compressive Strength of Fired Whiteware Materials, Method A. Thirty test specimens shall be used.
- 4.4 The ability of glass to resist chemical attack by water at elevated temperatures shall also be determined by ANSI/ASTM-C-158 except that the test specimens shall be conditioned for 1000 hours at 150°C in 100 percent RH prior to testing. Thirty test specimens with surfaces polished prior to humidity conditioning shall be used.
- 4.5 The ability of glass to resist thermal shock shall be determined by heating test specimens to 150°C and then rapidly immersing one face of the specimen in 0°C water. As test specimens shall represent plane windows, providing that their thickness and diameter (or width) exceed 0.5 and 4 inches, respectively, ten annealed and ten heat-treated test specimens shall be used.

5.0 Evaluation of Test Results

- 5.1 The test results generated by test procedures of Section 4 shall be covered against baseline values established by experience as the minimum acceptable performance level for glass utilized in windows for explosion proof enclosures.
- 5.2 The baseline values which the glass windows must meet are:
 - a. Annealing point, per procedure 4.1. $\geq 400^{\circ}\text{C}$
 - b. Modulus of rupture at a level of two percent ≥ 4000 psi of a population, per procedure 4.2.
 - c. Compressive strength at a level of two ≥ 4000 psi percent of a population, per procedure 4.3.
 - d. Resistance to chemical attack, as determined ≥ 3000 psi by the modulus of rupture at a level of two percent of a population, after 10,000 hours

of conditioning at elevated temperature per procedure 4.4.

- e. Resistance to thermal shock, as established by procedure 4.5 no breakage

6.0 Acceptance Criteria

- 6.1 If all test results meet the criteria of 5.2, the glass composition shall be considered acceptable for manufacture of pressure resistant window in annealed, or tempered conditions.
- 6.2 Breakage of annealed windows under the thermal shock procedure of 4.5 restricts the manufacture of windows from this glass composition to thermally tempered condition.
- 6.3 Test results failing to meet all criteria of 5.2 make the glass composition under consideration unacceptable for manufacture of pressure-resistant glass windows.

APPENDIX D

Material Qualification Procedure for Plastics

1.0 Scope

This set of procedures establishes criteria for selection of plastics suited for service as windows in explosion proof enclosures located in underground mines.

2.0 Applicable Documents

ASTM-D-621	Deformation of Plastics Under Load
ASTM-D-635	Flammability of Self-Supporting Plastics
ASTM-D-638	Tensile Properties of Plastics
ASTM-D-648	Deflection Temperature of Plastics Under Load
ASTM-D-695	Compressive Properties of Rigid Plastics
ASTM-D-732	Shear Strength of Plastics
ASTM-D-759	Determining the Physical Properties of Plastics at Subnormal and Supernormal Temperatures
ASTM-D-790	Flexural Properties of Plastics
ASTM-D-573	Rubber Deterioration in Air Oven
ASTM-D-1929	Ignition Properties of Plastics
ASTM-E-308	Ultraviolet Transmittance
ANSI/ASTM-G-26	Operating Light Exposure Apparatus (Xenon Arc Type) with and without Water for Exposure of Non-Metallic Materials
ASTM-D-256	Impact Resistance of Plastics
ASTM-D-2565	Operating Xenon Arc Type Light Exposure Apparatus with and Without Water for Exposure of Plastics

3.0 Significance

3.1 The self-ignition temperature of plastic must be sufficiently higher than the design temperature to prevent the plastic from being ignited by heat alone, while the flammability rate must be so low that after an exposure to ignited gases and coal dust for 30 seconds it will extinguish itself once the source of flame has been extinguished by lack of oxygen inside the enclosure.

3.2 The tensile, compressive and shear strength of plastic must exceed, by an adequate margin, the design stresses generated in the window by design pressure at design temperature and humidity.

3.3 The total deformation of plastic at design stress and design temperature must not be so excessive as to destroy the functional usefulness of the window.

3.4 The plastic must exhibit sufficient resistance to thermal aging and ultraviolet radiation generated by the light source to prevent significant decrease in structural properties of the window in an unacceptably short period of time.

3.5 The plastic must possess the proper combination of tensile strength and linear coefficient of thermal expansion to prevent the thermal shock, generated by momentary immersion of the hot enclosure in water, from fracturing the window.

4.0 Test Procedures

4.1 The self-ignition temperature of the plastic shall be determined by ASTM-D-1929, Procedure B.

4.2 Relative flammability of the plastic shall be determined by ASTM-D-635 modified to reflect the conditions inside the explosion-proof enclosure. The modification to the standard test method consists of using a larger test specimen (0.5 x 5 x 8 inches instead of 0.25 x 0.5 x 5 inches), and placement of the bunsen burner 3 inches away from the end so that the flame does not reach any of the specimen's edges.

4.3 The structural properties of the plastic at standard laboratory atmosphere shall be established by subjecting material test specimens to the following standard test procedures:

ASTM-D-638	Tensile Strength, Modulus of Elasticity and Elongation at Fracture
ASTM-D-695	Compressive Yield Strength, Modulus of Elasticity
ASTM-D-732	Shear Strength
ASTM-D-256	Impact Resistance
ASTM-D-790	Flexural Strength, Modulus of Elasticity
Method 11, Procedure A	

ASTM-D-621	Deformation Under Load, 4000 psi, 122°F, 24 hours
ASTM-E-308	Ultraviolet Transmittance

4.4 The upper deflection temperature of plastic under short term loading shall be established by ASTM-D-648, Procedure 6.1.

4.5 The structural properties and projected life of plastic in the environment found inside of enclosures shall be established by performance of short term tests according to ASTM-D-759 on two separate populations of test specimens. One population shall consist of specimens machined from unaged and unweathered plastic, while the other population shall consist of identical test specimens machined from plastic that has been aged and weathered.

4.5.1 The short-term tests shall establish:

- a. tensile properties per ASTM-D-638
- b. compressive properties per ASTM-D-695
- c. shear properties per ASTM-D-732
- d. impact properties per ASTM-D-256, Procedure B

at ambient test temperatures T_1 (upper deflection temperature minus 25°C) and T_2 (upper deflection temperature minus 50°C).

4.5.2 Thermal aging of plastic shall be conducted according to ASTM-D-1870 in 100 RH for 10,000 hours on two sets of specimens, one set at T_1 and another at T_2 temperatures. Following thermal aging, all specimens shall be subjected to simulated weathering for 10,000 hours.

4.5.3 Simulated weathering of all test specimens shall be conducted for 10,000 hours according to ASTM-D-2565 utilizing Standard Practice ASTM-G-26, Procedure A, Filter Combination 4.1.2.1.e.

4.6 The ability of plastic to resist thermal shock shall be determined by heating one set of test specimens to T_1 and another to T_2 and then rapidly immersing one face of the specimen in 0°C water. As test specimens shall serve plane windows, their thickness and diameter (or width) must exceed 0.5 and 4 inches, respectively. Ten test specimens shall be used.

5.0 Evaluation of Test Results

5.1 The test results generated by test procedures of Section 4 shall be used to establish:

- a. Acceptability for service as windows in explosion-proof enclosures
- b. Baseline for structural performance at room temperature
- c. Maximum design temperature
- d. Maximum design stress at design temperature
- e. Structural life at design temperature.

5.2 Plastic is considered nonflammable for service as windows in explosion-proof enclosures when its self-ignition temperature per procedure 4.1 exceeds 500°C, and, when ignited, is found to be nonburning by procedure 4.2.

5.3 The baseline for structural performance at standard laboratory atmosphere shall be arrived at by averaging the results generated by tests of procedure 4.3.

5.4 The maximum design temperature shall be arrived at by the following method:

- Step 1 - Find the average upper deflection temperature by averaging the temperatures resulting from procedure 4.4.
- Step 2 - Define the limits of potential maximum design temperature range by setting the limits T_1 and T_2 equal to the upper deflection temperature minus 25 and 50°C, respectively.
- Step 3 - Compare the averages of test results obtained by testing at T_1 and T_2 of (a) fresh plastic and (b) aged and weathered plastic according to procedure 4.5.3.
- Step 4 - If the comparison shows that the decrease of tensile, compressive or shear strength is less than 25 percent for either T_1 or T_2 then T_1 shall be selected as the maximum design temperature. If the decrease in

strength exceeds 25 percent at T_1 but is less than 25 percent at T_2 , then T_2 shall be considered to be the value of maximum design temperature.

Step 5 - A case may arise, however, where the decrease in strength exceeds 25 percent at both T_1 and T_2 temperatures. In such a case the test procedure 4.5 shall be repeated at T_3 , equal to upper deflection temperature minus 75°C . If the decrease in strength at T_3 is less than 25 percent, T_3 becomes the maximum design temperature.

5.5 The values of maximum design stress in tension, compression, and shear at design temperature shall be established by taking one-fourth of the average values of short-term strength generated by test procedure 4.5 on fresh test specimens.

5.6 The structural life of plastic at maximum design temperature shall be arrived at by extrapolating the decrease in structural strength generated by procedure 4.5. The allowable structural life is computed by the following method:

Step 1 - Plot on rectangular coordinates the ages and average values of short-term tensile strength generated by testing of fresh and of aged and weathered specimens at maximum design temperature. The strength value of fresh specimens shall be assigned an age of 1 hour, while the strength value of aged and weathered specimens shall be assigned an age of 10,000 hours.

Step 2 - Draw a straight line through the two points plotted in Step 1 and extend it to 100,000 hours.

Step 3 - Find that point on the graph where only 50 percent of the strength originally measured on fresh specimens remains.

Step 4 - Read from the graph the projected age of that point. The projected age at which the plastic is predicted to lose 50 percent of its original tensile strength at

maximum design temperature defines the limit of useful life for the plastic window.

5.7 Establish notched Izod impact resistance at design temperature at the end of its structural life by extrapolating graphically the impact properties obtained in procedure 4.5 and plotted on rectangular coordinates.

6.0 Acceptance Criteria

6.1 Plastic is considered to be acceptable for service as windows in explosion-proof enclosures if it meets the following conditions:

- a. Self-ignition point, ASTM-D-1929 $\geq 500^{\circ}\text{C}$.
- b. Flammability per procedure 4.2 (modified ASTM-D-635)--non-burning.
- c. Upper deflection temperature, ASTM-D-648 $\geq 125^{\circ}\text{C}$.
- d. Maximum design temperature, procedure 5.4 $\geq 100^{\circ}\text{C}$.
- e. Tensile strength at design temperature ≥ 4000 psi per ASTM-D-759 and ASTM-D-638.
- f. Resistance to thermal shock, procedure 4.6--nonfracturing.
- g. Structural life, procedure 5.6 ≥ 5 years.
- h. Notched Izod impact resistance at design temperature, extrapolated per procedure 5.7 to end of structural life, ≥ 0.4 ft lb/in. of notch.

6.2 Failure to meet any of the criteria of 6.1 makes the plastic unacceptable for service as windows in explosion-proof enclosures.

APPENDIX E

Material Quality Assurance Procedures for Plastics

1.0 Scope

This set of procedures establishes criteria for quality assurance of structural properties in plastics qualified by procedures of Appendix D for service as windows in explosion-proof enclosures located in underground mines.

2.0 Applicable Documents

ASTM-D-256	Impact Resistance of Plastics
ASTM-D-621	Deformation of Plastics Under Load
ASTM-D-638	Tensile Properties of Plastics
ASTM-D-648	Deflection Temperature of Plastics Under Load
ASTM-D-695	Compressive Properties of Rigid Plastics
ASTM-D-732	Shear Strength of Plastics
ASTM-D-790	Flexure Properties of Plastics
ASTM-E-308	Ultraviolet Transmittance

3.0 Significance

These procedures are to serve as a quality assurance program during the selection of a manufacturer whose product meets the structural requirements established for a qualified plastic by procedure 4.3 of Appendix D. It is postulated that if the given commercial grade of qualified plastic has structural properties which equal, or surpass, the average values generated by procedures 4.3 and 4.4 of Appendix D, then its structural properties at maximum design temperature, resistance to heat aging and weathering shall also meet the acceptance criteria of 6.1 in Appendix D without further testing.

4.0 Test Procedures

4.1 Test specimens shall be machined from a sheet of the commercial grade of plastic submitted by the manufacturer of plastics for fabrication of windows.

4.2 If the plastic is supplied in the shape of extruded or molded shapes like cylinders or domes, the specimens shall be machined from segments cut out of these shapes.

4.3 The structural properties of the commercial grade of plastic submitted by the manufacturer shall be established by subjecting material test specimens to the following standard test methods:

ASTM-D-638	Tensile Strength, Modulus of Elasticity and Elongation at Fracture
ASTM-D-695	Compressive Yield Strength, Modulus of Elasticity
ASTM-D-732	Shear Strength
ASTM-D-256	Impact Resistance
Method A	
ASTM-D-790	Flexural Strength, Modulus of Elasticity
Method 11	
Procedure A	
ASTM-D-621	Deformation Under Load at 4000 psi and 122°F, 24 hours
ASTM-E-308	Ultraviolet Transmittance

4.4 The upper deflection temperature of the plastic shall be established by ASTM-D-648, Procedure 6.1.

5.0 Evaluation of Test Results

5.1 The test results generated by test procedures 4.3 and 4.4 of this appendix shall be compared against baseline values generated by Test Procedures 4.3 and 4.4 of Appendix D.

5.2 The comparison shall be made only between average values for each of the properties tested and the computed difference recorded as percent of average values generated by Procedures 4.3 and 4.4 of Appendix D.

6.0 Acceptance Criteria

6.1 The commercial grade of plastic submitted by a manufacturer of plastics for construction of windows in explosion-proof enclosures shall be considered acceptable if the following conditions are met:

- a. The family of plastics, to which this particular grade belongs chemically, has already been qualified for window service by meeting the requirements of Appendix D.
- b. The magnitude of difference between average values of structural properties obtained previously by Procedures 4.3 and 4.4 of Appendix D, and those generated by Procedures 4.3 and 4.4 of this appendix indicates that the structural grade of plastic under evaluation is of the same, or of structurally superior quality as the grade of plastic which qualified this family of plastics for window service.

6.2 If the magnitude of difference is 10 percent, or less, the commercial grade of plastic under evaluation is considered to be of the same quality as the grade of plastic which qualified this family of plastics for window service.

6.3 Larger differences are acceptable providing they are in the right direction, i.e., make the plastic structurally more desirable for window service. For all the physical properties, except deformation under load (ASTM-D-621) and ultraviolet transmittance (ASTM-E-308), differences should be in the positive direction, while for the two exceptions the differences should be in the negative direction.

Positive difference results when the average test value generated by a procedure of this appendix surpasses the average test value generated previously.

7.0 Baseline Values for Qualified Plastics

7.1 The following families of plastics have been, to date, qualified for service as windows in explosion-proof lamp enclosures.

- a. Polycarbonate plastics, UV stabilized, with properties meeting the baseline requirements of Section 7.2.

7.2 Baselines of qualified plastics are:

Polycarbonate Plastics

ASTM-D-639:	Tensile Strength	≥ 9000 psi
	Modulus of Elasticity	$\geq 300,000$ psi
	Elongation at fracture	≥ 20 percent
ASTM-D-695:	Compressive Yield	$\geq 12,000$ psi
	Modulus of Elasticity	$\geq 300,000$ psi
ASTM-D-732:	Shear Strength	≥ 9000 psi
ASTM-D-790: Method 11 Procedure A	Flexural Strength	$\geq 12,000$ psi
	Modulus of Elasticity	$\geq 300,000$ psi
ASTM-D-621:	Compressive Deformation Under Load at 4000 psi and 122 F, 24 hours	≥ 2 percent
ASTM-D-256: Method A	Izod notched impact	≥ 12 ft-lbs/in. of notch
ASTM-E-308:	UV transmittance	≤ 5 percent

APPENDIX F

Qualification Procedure for Cast-In-Place Elastomeric Dams

1.0 Scope

This set of procedures establishes criteria for the selection of elastomers suited for service as preformed bearing gaskets between windows and their seats in explosion-proof enclosures.

2.0 Applicable Documents

ASTM-D-395	Rubber Property - Compression Set
ASTM-D-412	Tension Testing of Vulcanized Rubber
ASTM-D-471	Rubber Property, Effect of Liquids
ASTM-D-568	Flammability of Flexible Plastics
ASTM-D-575	Rubber Properties in Compression
ASTM-D-624	Rubber Property - Tear Resistance
ASTM-D-732	Shear Strength of Plastics
ASTM-D-759	Determining the Physical Properties of Plastics at Subnormal and Supernormal Temperatures
ASTM-D-573	Rubber Deterioration in an Air Oven
ASTM-D-1349	Rubber, Standard Temperatures and Atmospheres
ASTM-D-1929	Ignition Properties of Plastics
ASTM-D-2240	Indentation Hardness of Rubber and Plastics by Means of a Durometer
ASTM-F-36	Compressibility and Recovery of Gasket Materials
ASTM-F-38	Creep Relaxation of a Gasket Material
ASTM-D-2565	Xenon Arc-Type Light Exposure

3.0 Significance

3.1 The gasket material must be endowed with such physical properties that it may serve without significant deterioration in a 100 to 150°C temperature and 100%, RH environment as a precompressed elastic cushion

on the seat for glass or plastic windows. These properties are enumerated, and the test procedures for their determination defined, in Section 4.

4.0 Test Procedures

4.1 The self ignition temperature of the material shall be determined by ASTM-D-1929.

4.2 The flammability of the material, once it is exposed to open flame, shall be defined by ASTM-D-568.

4.3 The physical properties of the gasket material at standard laboratory environment shall be defined by standard test procedures enumerated below and the test results shall serve as that material's baseline for any future comparisons. These standard test procedures are:

ASTM-D-395	Compression Set, Constant 1000 psi, 24 hours
ASTM-D-412	Tensile Strength, Ultimate Elongation
ASTM-D-732	Shear Strength
ASTM-D-624	Tear Resistance
ASTM-D-2240	Indentation Hardness
ASTM-F-36	Compressibility and Recovery
ASTM-F-38	Creep Relaxation, 1000 psi, 24 hours
ASTM-D-575	Compressive Strain at 1000 psi

4.4 The structural properties, and the projected life, of the gasket material in the environment found inside of lamp enclosures shall be established by performance of:

- a. Standard short-term tests according to ASTM-D-759 on two separate populations of test specimens, young and aged. The young population shall consist of fresh oven-cured standard test specimens while the aged population shall consist of similar standard test specimens that have, after oven curing, been thermally aged and weathered. Oven curing is defined here as conditioning of gasket material at design temperature for 250 hours prior to initiation of testing.

- b. Standard long term tests performed on young specimens only.

4.4.1 The short term tests shall establish the following properties:

- a. tensile strength and elongation per ASTM-D-412
- b. tear resistance per ASTM-D-624
- c. indentation hardness per ASTM-D-2240
- d. strain at 1000 psi compressive stress per ASTM-D-575 at ambient test temperatures of 150°C and 125°C. These temperatures, besides meeting the requirements of ASTM-D-1349, are also typical maximum design temperatures for glass and plastic windows, respectively.

4.4.2 The long-term tests shall establish the following properties of the material:

- a. ASTM-F-38: Creep relaxation under 1000 psi after 24, 100, 1000 and 10,000 hours in ambient environments of 150 and 125°C at 100 percent RH.
- b. ASTM-D-471: Change in tensile strength, elongation hardness, and volume after 166 hours immersion in water at 100°C.

4.4.3 Thermal aging of the gasket material shall be conducted according to ASTM-D-573 in 100 percent RH for 10,000 hours. Following thermal aging, the material shall be subjected to simulated weathering for 10,000 hours according to ASTM-D-2565, utilizing Standard Practice ASTM-G-26, Procedure A, Filter Combination 4.1.2.1.e.

5.0 Evaluation of Test Results

5.1 The test results generated by the test procedures of Section 4 shall be used to establish:

- a. Baseline for structural permanence in standard laboratory atmosphere
- b. Acceptability for service as gaskets on seats for windows in explosion-proof enclosures
- c. Maximum design temperature
- d. Maximum design loading criteria
- e. Service life at maximum design temperature

5.2 The gasket material is considered nonflammable for service as windows in explosion-proof enclosures when its self-ignition temperature per procedure 4.1 exceeds 500°C, and, when ignited, is found to be self-extinguishing by procedure 4.2.

5.3 The baseline for structural performance in a standard laboratory atmosphere shall be arrived at by averaging the test results generated by procedure 4.3.

5.4 The maximum design temperature for the gasket material shall be arrived at by the following method.

Step 1 - Average the test results generated by procedure 4.4.

Step 2 - Compare the averages of test results obtained by short-term tests performed at 150°C and 125°C on (a) young, and (b) aged and weathered specimens.

Step 3 - Compare the creep relaxations resulting from long term tests of 24, 100, and 10,000 hour duration at 150°C and 125°C ambient temperature.

Step 4 - If the comparison shows that:

- a. The decrease of tensile strength, maximum elongation, tear strength, and compressive strain under 1000 psi compression, at 150°C ambient temperature and 100 percent RH, is less than 25 percent.
- b. The increase in creep relaxation from 1000 to 10,000 hours at 150°C and 100 percent RH is less than 25 percent, then 150°C shall be considered to be the value of maximum design temperature.

Step 5 - If the comparison of data generated at 150°C fails to meet the material deterioration criteria of ≤ 25 percent, a similar comparison shall be made for data generated by tests at 125°C ambient temperature. Assuming that the comparison of data generated at 125°C satisfies the material deterioration criterion of ≤ 25 percent the 125°C shall be considered to be the value of maximum design temperature.

Step 6 - A case may arise, however, where even the comparison of data at 125°C fails to meet the material deterioration criterion of ≤ 25 percent. In such a case the test procedure 4.4 shall be repeated at 100°C, and the data evaluated by procedure 5.4. If the comparison of data at 100°C satisfies the material deterioration criterion of ≤ 25 percent, the maximum design temperature shall be considered to be 100°C.

5.5 The values of maximum design stress in tension and tear resistance shall be computed by taking one-fourth of the average value of short term strength generated by test procedure 4.4.1 on young specimens at maximum design temperature which was arrived at by procedure 5.4. The value of maximum compressive stress generated during precompression of the gasket under standard laboratory atmosphere shall not exceed 1000 psi based on strains established by ASTM-D-575 in procedure 4.3.

5.6 Service life of the gasket material, at maximum design temperature of procedure 5.4, shall be arrived at by extrapolating the decrease in tensile strength generated by procedure 4.4. The allowable service life is computed by the following method:

Step 1 - Plot on rectangular coordinates the ages and average values of short term tensile strength generated by the testing of young, oven-cured and of aged and weathered specimens at maximum design temperature according to Procedure 4.4. The strength value of young, oven-cured specimens shall be assigned an age of 250 hours, while

the strength value of aged and weathered specimens shall be assigned an age of 10,000 hours.

Step 2 - Draw a straight line through the two points plotted in Step 1 and extend it to 100,000 hours.

Step 3 - Find that point on the graph where only 50 percent of the strength originally measured on young, oven-cured specimens remains.

Step 4 - Read from the graph the projected age of that point. The projected age at which the material is predicted to lose 50 percent of its original tensile strength at maximum design temperature defines the limit of the service life for the elastomeric gasket.

5.7 Establish indentation hardness in the design temperature environment, at the end of its service life, by extrapolating, graphically, the indentation hardness obtained in procedure 4.4 and plotted on rectangular coordinates.

6.0 Acceptance Criteria

6.1 An elastomeric material is considered acceptable for service as gaskets on window seats in explosion-proof enclosures, if it meets the following conditions.

- a. Self ignition point, ASTM-D-1929, $\leq 500^{\circ}\text{C}$.
- b. Flammability, ASTM-D-569, self extinguishing.
- c. Maximum design temperature, procedure 5.4, $\geq 100^{\circ}\text{C}$.
- d. Tensile strength at design temperature ≥ 300 psi per ASTM-D-412 and ASTM-D-759.

- e. Service Life at design temperature and 100 percent RH $\geq$ 5 years.
- f. Indentation hardness at design temperature, ASTM-D-2240, $30 \leq D \leq 90$.
- g. Indentation hardness at design temperature, at end of service life, procedure 5.7 and ASTM-D-2240, $30 \leq D \leq 90$.
- h. Swelling in water at 100°C after 166 hours immersion, ASTM-D-471, ≤ 5 percent.

6.2 Failure to meet any of the criteria of 6.1 makes the material unacceptable for service as gaskets on window seats in explosion-proof enclosures.

APPENDIX G

Material Qualification Procedure for Preformed Gasket Materials

1.0 Scope

This set of procedures establishes criteria for selection of elastomers suited for service as cast in place elastomeric seals between windows and their seats in explosion-proof enclosures.

2.0 Applicable Documents

ASTM-D-412	Tension Testing of Vulcanized Rubber
ASTM-D-471	Effect of Liquids
ASTM-D-568	Flammability of Flexible Plastics
ASTM-D-624	Rubber Property, Tear Resistance
ASTM-D-2182	Strength Properties of Metal-to-Metal Adhesives by Compression Loading (Disc Shear)
ASTM-D-759	Determining the Physical Properties of Plastics at Subnormal and Supernormal Temperatures
ASTM-D-573	Rubber Deterioration in an Air Oven
ASTM-C-794	Adhesion-in-Peel of Elastomeric Joint Sealants
ASTM-D-1349	Rubber, Standard Temperatures and Atmospheres
ASTM-D-1929	Ignition Properties of Plastics
ASTM-D-2240	Indentation Hardness of Rubber and Plastics by Means of a Durometer
ASTM-D 746	Brittleness Temperature of Plastics and Elastomers
ASTM-D 2565	Xenon Arc-Type Light Exposure

3.0 Significance

3.1 The material used for cast-in-place elastomeric seals must be endowed with physical properties that will allow it to maintain a crack-free seal between the window and its seat in a wide range of temperatures and atmospheres encountered by the explosion-proof enclosure during transportation by air, warehouse storage, in service. These physical properties are enumerated, and the test procedures for their determination defined, in Section 4.

4.0 Test Procedures

4.1 The self-ignition temperature of the material shall be determined by ASTM-D-1929.

4.2 The flammability of the material, once it is exposed to open flame shall be defined by ASTM-D-568.

4.3 The physical properties of the material at standard laboratory environment shall be defined by standard test procedures enumerated below and the test results shall serve as that material's baseline for any future comparisons. These standard test procedures are:

ASTM-D-412	Tensile Strength and Elongation
ASTM-D-624	Tear Resistance
ASTM-D-746	Brittleness Temperature
ASTM-D-2240	Indentation Hardness
ASTM-D-2182	Shear Strength
ASTM-C-794	Adhesion in Peel

4.4 The structural properties and the projected service life of the cast-in-place seal material in the ambient environment found inside enclosures shall be established by performance of:

- a. Standard short term tests according to ASTM-D-759 on two separate populations: young and old.
- b. Standard long-term tests performed on young specimens only. The young population shall consist of fresh oven-cured standard test specimens, while the aged population shall consist of similar standard test specimens that have, after oven-curing, been thermally aged and artificially weathered. Oven curing is defined here as conditioning of the seal material at design temperature for 250 hours prior to initiation of testing.

4.4.1 The short-term tests shall establish the following properties:

ASTM-D-412	Tensile Strength and Elongation
ASTM-D-624	Tear Resistance
ASTM-D-2182	Shear Strength
ASTM-C-794	Adhesion in Peel
ASTM-D-2240	Indentation Hardness

at ambient Temperatures of 150° and 125°C in 100 percent RH. These temperatures are typical maximum design temperatures for glass and plastic windows, respectively.

4.4.2 The long-term tests shall establish the following properties of the material:

ASTM-D-471	Swelling, change in tensile strength and elongation after 166 hours submersion in water at 100°C.

4.4.3 Thermal aging of cast-in-place seal material shall be conducted according to ASTM-D-573 in 100 percent RH for 10,000 hours at 150 and 125°C. Following thermal aging, the material shall be subjected to simulated weathering for 10,000 hours according to ASTM-D-2565, utilizing Standard Practice ASTM-G-26, Procedure A, Filter Combination, 4.1.2.1.e.

5.0 Evaluation of Test Results

5.1 The test results generated by the test procedures of Section 4 shall be used to establish:

- a. Baseline for structural performance in standard laboratory atmosphere.
- b. Acceptability for service as cast-in-place seals for windows in explosion-proof enclosures.
- c. Maximum design temperature.

d. Maximum design stress criteria.

e. Service life at maximum design temperature.

5.2 The material is considered nonflammable for service as cast-in-place seal around windows in explosion-proof enclosures when its self-ignition temperature per procedure 4.1 exceeds 500°C, and when ignited, is found to be self-extinguishing by procedure 4.2.

5.3 The baseline for structural performance in standard laboratory atmosphere shall be arrived at by averaging the test results generated by procedure 4.3.

5.4 The maximum design temperature for the cast-in-place seal material shall be arrived at by the following method:

Step 1 - Average the test results generated by procedure 4.4.1

Step 2 - Compare the averages of test results obtained by short-term tests performed at 150 and 125°C on (a) young, and (b) aged and weathered specimens.

Step 3 - If the comparison shows that the decrease of tensile strength, tear resistance, shear strength, and peel strength at 150°C ambient temperatures and 100 percent RH is less than 25 percent then 150°C shall be considered to be the value of maximum design temperature.

Step 4 - If the comparison of data generated by 150°C fails to meet the material deterioration criteria of Step 3, a similar comparison shall be made for data generated by short term tests at 125°C ambient temperature. Assuming that the comparison of data generated at 125°C satisfies the material deterioration criterion of ≤ 25 percent, then 125°C shall be considered to be the maximum design temperature.

Step 5 - A case may arise, however, where even the comparison of data at 125°C fails to meet the material deterioration criterion of ≤ 25 percent. In such a case the test procedure 4.4 shall be repeated at 100°C, and the data

evaluated by procedure 4.5. If the comparison of data generated at 100°C satisfies the material deterioration criterion of ≤ 25 percent, the maximum design temperature shall be considered to be 100°C.

5.5 The values of maximum design stress in tension, tear resistance, shear, and peel resistance for the cast-in-place seal material shall be computed by taking one-fourth of the average value of short-term strength generated by test procedure 4.4.1 on young specimens at maximum design temperature which was arrived at by procedure 5.4.

5.6 The service life of cast-in-place seal material at maximum design temperature of procedure 5.4 shall be arrived at by extrapolating the decrease in tensile strength generated by procedure 4.4.

Step 1 - Plot on rectangular coordinates the ages and average values of short-term tensile strength generated by the testing of young oven-cured, and of aged and weathered specimens at maximum design temperature according to procedure 4.4. The strength value of young, oven-cured specimens shall be assigned an age of 250 hours, while the strength value of aged and weathered specimens shall be assigned an age of 10,000 hours.

Step 2 - Draw a straight line through the two points plotted in Step 1 and extend it to 100,000 hours.

Step 3 - Find that point on the graph where only 50 percent of the strength originally measured on young, oven-cured specimens remains.

Step 4 - Read from the graph the projected age of that point. The projected age at which the material is predicted to lose 50 percent of its original tensile strength at maximum design temperature defines the limit of the service life for the cast-in-place elastomeric seal.

5.7 Establish peel adhesion in the design temperature environment, at the end of its service life, by extrapolating graphically the peel adhesion obtained in procedure 4.4 and plotted on rectangular coordinates.

6.0 Acceptance Criteria

6.1 A cast-in-place elastomeric material is considered acceptable for service as seals around windows in explosion-proof enclosures if it meets the following conditions:

- a. Self-ignition point, ASTM-D-1929, $\geq 500^{\circ}\text{C}$
- b. Flammability, ASTM-D-569, self-extinguishing
- c. Maximum design temperature, procedure 5.4, $\geq 100^{\circ}\text{C}$
- d. Tensile strength at design temperature, ASTM-D-412 and ASTM-D-759, ≥ 200 psi
- e. Tensile elongation at design temperature, ASTM-D-412, ≥ 200 percent
- f. Adhesion in peel at design temperature, ASTM-C-794, ≥ 10 psi
- g. Shear strength at design temperature, ASTM-D-2182, ≥ 100 psi
- h. Service life at design temperature and 100 percent RH, procedure 5.6, ≥ 5 years
- i. Adhesion in peel at design temperature and 100 percent RH, at end of the service life per procedure 5.0, ≥ 5 psi
- j. Swelling in water at 100°C after 166 hours immersion, ASTM-D-471, ≤ 5 percent.
- k. Decrease in tensile strength after 166 hours immersion in 100°C water, ASTM-D-471, ≤ 25 percent.

6.2 Failure to meet any of the criteria of 6.1 makes the material unacceptable for service as cast-in-place seals around windows in explosion-proof enclosures.

