



Piping Solutions, Inc.

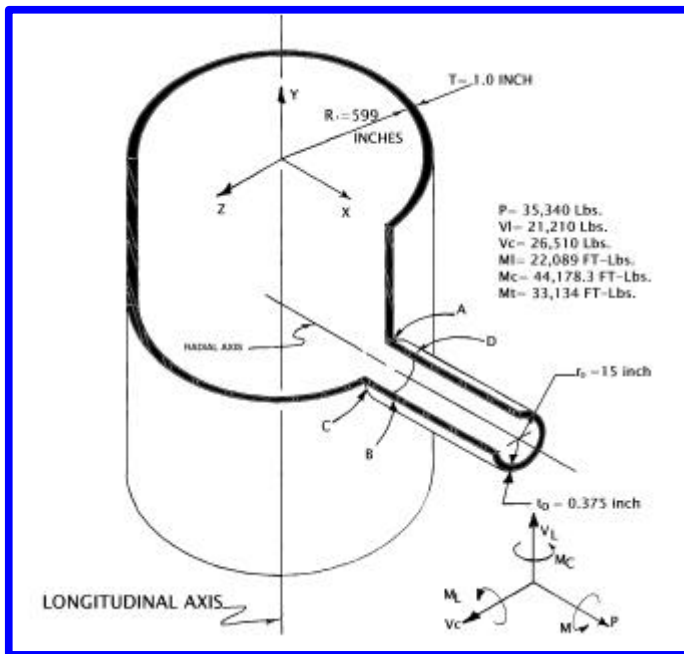
6219 Brittmoore Road, Houston, Texas 77041-5114, U.S.A.

Telephone: 713-849-3366 * FAX: 713-849-3806

E-mail: info@PipingSolutions.com * Website: www.PipingSolutions.com

ANALYSIS OF STRESSES IN PRESSURE VESSEL AND TANK SHELLS AT NOZZLE AND CLIP CONNECTIONS RESULTING FROM EXTERNAL LOADS

WERCO 107/297 is a comprehensive software package for calculating stresses in shells in accordance with the guidelines set forth in the Welding Research Council Bulletins 107 & 297. The program eliminates the need for hours of tedious hand calculations and manual cross-referencing and dramatically reduces the possibility of errors.



GENERAL FEATURES

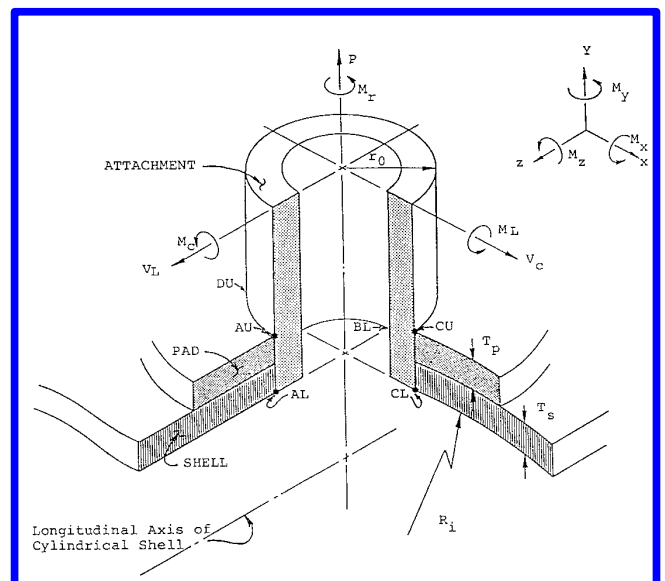
- ◆ Easy to use Data Entry Dialog screens
- ◆ Easy to understand HELP screens
- ◆ Extensive Data Checking
- ◆ Imperial and International units
- ◆ Support provided by experienced engineers.

WERCO 107/297 CAPABILITIES

- ◆ Calculates stresses at eight points on the shell at the nozzle, clip or lug intersection
- ◆ Automatically compares calculated maximum combined stress intensity with the allowable stress value – automatically increases reinforcing pad thickness until the calculated stress value is found to be less than the allowed stress
- ◆ Determines worst combination of positive and negative loads and then designs a reinforcing pad so that the calculated stress is less than the allowed stress.

WERCO 107/297 APPLICATIONS

- ◆ Provides an effective tool for evaluating the ability of a nozzle to withstand the forces and moments applied by piping
- ◆ Provides an effective tool for evaluating the ability of a clip to withstand the force and moment loads applied by piping, structural members and equipment
- ◆ Provides an effective tool for evaluating the ability of a lifting lug to withstand the forces and moments applied to it at lift
- ◆ Provides technical compliance and documentation for regulatory authorities
- ◆ Enables an engineer/designer to determine the reinforcement required in spherical and cylindrical shell at the intersection of a nozzle, a clip or a lifting lug.



WERCO 107/297 INPUT

WERCO - WERCO

File Edit Calculate View Help

Title: Cylindrical Shell with Round Attachment

Options: Code: WRC107, Input Unit: English, Output Unit: English, Processing: Analysis, New Stress Intensity: WRC297, Marc, MMRC, Design

Geometry: Shell: Spherical, Cylindrical, or Spherical. Attachment: Round, Rectangular, or Hollow. Solid or Hollow. Wall Radius: 24 INCHES, Nozzle Radius: 3.315 INCHES, Wall Thickness: 0.75 INCHES, Nozzle Thickness: INCHES, Length: INCHES, Nozzle Cross Dia: INCHES, Nozzle Long Dia: INCHES

Reinforcing Pad: Pad Thickness: 0 INCHES, Pad Thickness Increment: 0.0625 INCHES, Min. Pad Thk.: 0.1 INCHES

Loads: Ax System: WRC or XYZ, Cylindrical Axis: 2, Attachment Direction: +Y. Moments about X, Y, Z axes: 700 LBS, 1400 LBS, 1800 LBS. Moments about X, Y, Z axes: 2500 FT-LBS, 5200 FT-LBS, 3000 FT-LBS.

Stress: Internal Pressure: 1500 PSI, Stress Concentration Factor: 1, Membrane Load - Fa: INCHES, Max. Allowable Combined Stress Intensity: 15000 PSI, Bending Load - Hb: INCHES.

Features: Reinforcing Pad: Radio Button

- ◆ Shell Geometry Shape (cylindrical or spherical)
- ◆ Attachment Geometry shape (round, square or rectangular – solid or hollow)
- ◆ Attachment Orientation to shell
- ◆ Loads (forces and moments) X, Y & Z
- ◆ Internal Pressure acting on shell
- ◆ Joint efficiency, if applicable
- ◆ Maximum Allowable Stress Intensity
- ◆ Maximum Reinforcing Pad Thickness.

WERCO 107/297 OUTPUT

- ◆ Input Echo with Error and Warning messages
- ◆ Stress Report in WRC 107 Spreadsheet Format
- ◆ Lists Bulletin Factors used in the calculations
- ◆ Required Reinforcing Pad Thickness
- ◆ Sizes Minimum Wall Thickness for nozzles
- ◆ Calculates Nozzle re-pads, if required

DATE: 05/22/2000 TENSION = + COMPRESSION = -

** MAXIMUM STRESS INTENSITY OPTION SELECTED **

** WERCO DESIGN OPTION SELECTED -

ALLOWABLE STRESS INTENSITY (PSI) 15000.

DESIGNED PAD THICKNESS (INCHES) 0.2500

OUTPUT DATA (ALL STRESSES ARE GIVEN IN (PSI))

CIRCUMFERENTIAL STRESSES-	TYPE	DUE TO	LOCATION		
			AD	AL	BU
MEMBRANE	(FY)	-595.	-595.	-595.	-595.
BENDING	(FY)	-2027.	2027.	-2027.	2027.
MEMBRANE	(MX)	0.	0.	0.	0.
BENDING	(MX)	0.	0.	0.	0.
MEMBRANE	(MY)	2201.	2201.	-2201.	-2201.
BENDING	(MY)	6440.	-6440.	-6440.	6440.
MEMBRANE STRESSES		1606.	1606.	-2795.	-2795.
BENDING STRESSES		4412.	-4412.	-8457.	8457.
TOTAL CIRCUMFERENTIAL STRESSES		6019.	-2806.	-11263.	5671.

LONGITUDINAL STRESSES- TYPE	DUE TO			
MEMBRANE (FY)	-482.	-482.	-482.	-482.
BENDING (FY)	-2770.	2770.	-2770.	2770.
MEMBRANE (MX)	0.	0.	0.	0.
BENDING (MX)	0.	0.	0.	0.
MEMBRANE (MY)	615.	615.	-615.	-615.
BENDING (MY)	10155.	-10155.	-10155.	10155.
MEMBRANE STRESSES	133.	133.	-1098.	-1098.
BENDING STRESSES	7386.	-7386.	-13925.	13925.
TOTAL LONGITUDINAL STRESSES	7518.	-7253.	-14023.	11828.

SHEAR STRESSES	DUE TO			
TORSIONAL MOMENT (MY)	1079.	1079.	1079.	1079.
SHEAR LOAD (FX)	-892.	-892.	892.	892.
SHEAR LOAD (FZ)	0.	0.	0.	0.
TOTAL SHEAR STRESSES	387.	387.	1771.	1771.

COMBINED STRESS INTENSITY 7612. 7886. 14886. 12301.