

WRC Bulletin 297

Published in August of 1984, Welding Research Council (WRC) 297 attempts to extend the existing analysis tools for the evaluation of stresses in cylinder-to-cylinder intersections. WRC 297 differs from the widely used WRC 107 primarily in that WRC 297 is designed for larger d/D ratios (up to 0.5), and that WRC 297 also computes stresses in the nozzle and the vessel. (WRC 107 only computes stresses in the vessel.)

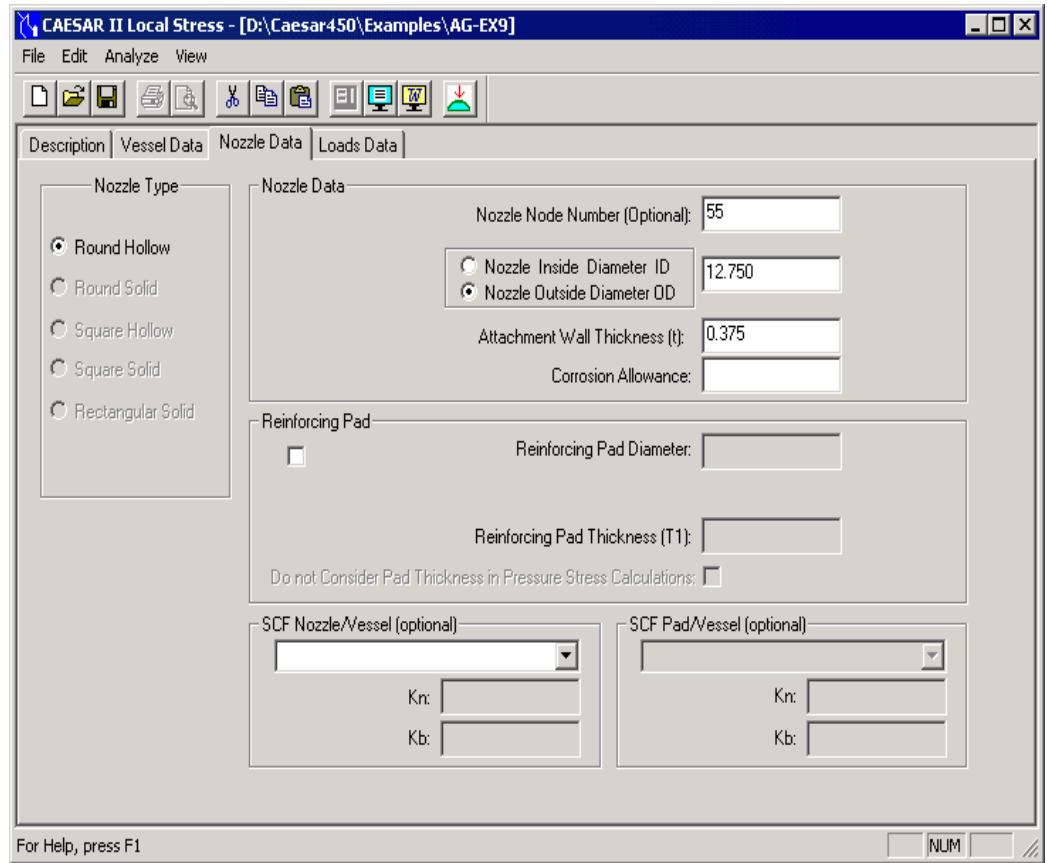
The CAESAR II WRC 297 module shares the same interface with WRC 107. To enable the WRC 297 analysis, from the *Vessel* tab, click the **WRC 297** radio button. The module provides spreadsheets for vessel data, nozzle data, and imposed loads. Vessel and Nozzle data fields function the same way as those in WRC 107. Currently WRC 297 supports one set of loads. The loads may be entered in either Global CAESAR II convention, or in the Local WRC 107 coordinate system. If Global CAESAR II convention is selected vessel and nozzle direction cosines must be present in order to convert the loads into the Local WRC 297 convention as discussed in the WRC 297 bulletin.

The screenshot displays the 'CAESAR II Local Stress' application window. The title bar shows the file path: 'D:\Caesar450\Examples\AG-EX9'. The menu bar includes 'File', 'Edit', 'Analyze', and 'View'. A toolbar with various icons is located below the menu bar. The main window is divided into several sections:

- Description:** A tabbed interface with 'Description', 'Vessel Data', 'Nozzle Data', and 'Loads Data' tabs. The 'Description' tab is currently active.
- Analysis Type:** Three radio buttons are present: 'WRC 107', 'WRC 297' (which is selected), and 'PD 5500 Annex G'.
- Vessel Type:** Two radio buttons: 'Cylindrical' (selected) and 'Spherical'.
- Vessel Data:**
 - Vessel Node Number (Optional): 60
 - Vessel Inside Diameter ID: 120.000
 - Vessel Outside Diameter OD: 120.000
 - Vessel Wall Thickness (T): 0.625
 - Vessel Corrosion Allowance: (empty field)
- Vessel Stress Intensity Allowable:**
 - Vessel Design Temperature: 500.000
 - Vessel Material Name: SA-516 70
 - Hot Allowable Stress (Smh): 20000.000
 - Cold Allowable Stress (Smc): 20000.000
- Additional Data:**
 - Include Pressure Stress Indices (Div.2):

At the bottom left, it says 'For Help, press F1'. At the bottom right, there is a 'NUM' button and a small icon.

Analysis - WRC 297



Nozzle Screen

CAESAR II Local Stress - [D:\Caesar450\Examples\AG-EX9]

File Edit Analyze View

Description | Vessel Data | Nozzle Data | Loads Data

Loads Specification

Global CAESAR II Convention
 Local WRC107 Convention

Centerline Direction Cosines

Vessel X:
Vessel Y:
Vessel Z:
 Z-Axis Vertical

Nozzle X:
Nozzle Y:
Nozzle Z:

Loads

Internal Pressure (P):
Include Pressure Thrust:

	SUS Forces	EXP Forces	OCC Forces
Global Force FX:	<input type="text" value="-26.000"/>	<input type="text" value="8573.000"/>	<input type="text"/>
Global Force FY:	<input type="text" value="-1389.000"/>	<input type="text" value="23715.000"/>	<input type="text"/>
Global Force FZ:	<input type="text" value="32.000"/>	<input type="text" value="-5866.000"/>	<input type="text"/>

	SUS Moments	EXP Moments	OCC Moments
Global Moment MX:	<input type="text" value="-65.000"/>	<input type="text" value="31659.000"/>	<input type="text"/>
Global Moment MY:	<input type="text" value="127.000"/>	<input type="text" value="-5414.000"/>	<input type="text"/>
Global Moment MZ:	<input type="text" value="4235.000"/>	<input type="text" value="-52583.000"/>	<input type="text"/>

For Help, press F1

WRC 297 - Loads

The **CAESAR II** version of WRC 297 also adds the pressure component of the stress using Lamé's equations, multiplied by the stress intensification factors found in ASME Section VIII, Div. 2, Table AD-560.7. The pressure stress calculation is not a part of the WRC 297 bulletin, but is added here as a convenience for the user.

Note **CAESAR II** also utilizes, through the piping input processor, the nozzle flexibility calculations described in WRC 297 refer to Chapter 3 of the Technical Reference Manual.

When provided with the necessary input, **CAESAR II** calculates the stress components at the four locations on the vessel around the nozzle and also the corresponding locations on the nozzle. Stresses are calculated on both the outer and inner surfaces (upper and lower). These stress components are resolved into stress intensities at these 16 points around the connection. Refer to the WRC 107 discussion for more information on the allowable limits for these stresses and output processing.