Version 2019.3, WRC module updates

We've updated the WRC module in version 2019.3; in this article we take a look at what's changed.

Online version: https://nextgen.sant-ambrogio.it/KB275000

Latest update: 29 ott 2019

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The 2019.3 version of NextGen introduces some small but significant variations in the WRC calculation module, dedicated to localized loads. This article summarizes these changes, comparing them with the previous behavior.

Simplified and advanced input mode

Since over time the WRC module has become increasingly enriched with an increasing number of options, we considered it appropriate to confine the less common use options in a sub-category, leaving only the fundamental ones visible by default.
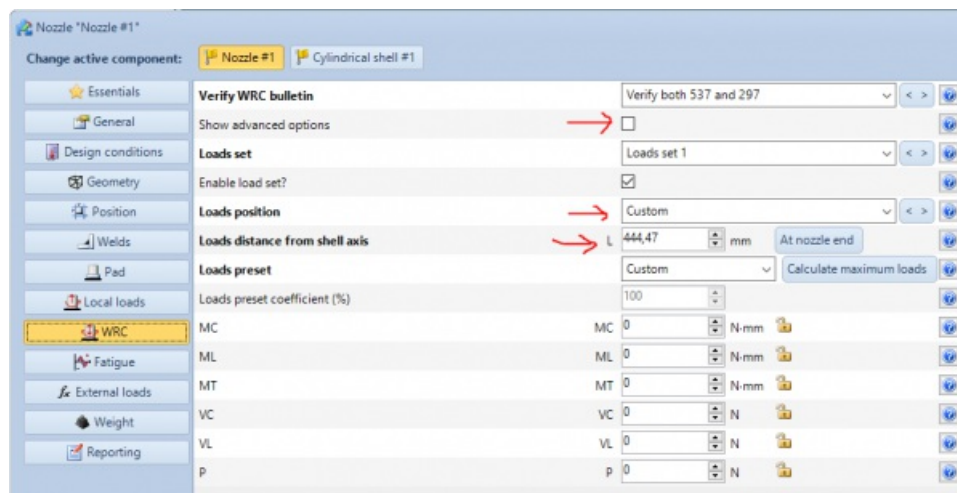
The default input mode is the simplified one. In this mode, only the values of the loads and their position are required. By default, the position is set to "Custom" and the distance from shell axis must be entered: it is possible to select "Mean shell diameter" if the loads are positioned at the medium fiber of the shell, or use the "At nozzle end" button if they are located at the piping connection.

By enabling "Show advanced options" all input options will be displayed as in previous versions.

Allowable value for local stresses in the nozzle

WRC does not indicate which are the maximum values to be used as a comparison with the stresses calculated with the bulletin. Until now, both for stresses in the shell and for those in the nozzle, we have conventionally used 1.5*allowable for membrane stresses,* 3*allowable for total stresses (membrane + bending).* We realized that in the case of local stresses in the nozzle (WRC 297), this value could be non-conservative: therefore, we have separated the coefficients relating to the stresses in the nozzle from those of the shell. Both the WRC 297 verification for stresses in the nozzle and the Roark validation of stresses at the flange connection now use as 1*allowable for membrane stresses,* 1.5*allowable for total stresses.* These values apply to new files, with the old ones importing the coefficients previously used. For some configurations, the maximum allowable stresses may therefore be lower than in the past.

Maximum local membrane stress based on	Allowable	< >
Local stress in shell allowable factor	1,5	
Local stress in nozzle allowable factor	1	
Maximum total stress based on	Allowable	< >
Total stress in shell allowable factor	3	
Total stress in nozzle allowable factor	1,5	

Combined stress intensity

We have refined the method of calculating the combined stress intensities; previously, for all the bulletins the method described in WRC 107 was used, as shown below.

COMBINED STRESS INTENSITY - S

1) When $\tau \neq 0$, S = largest absolute magnitude of either

$$S = 1/2 \left[\sigma_x + \sigma_\phi \pm \sqrt{(\sigma_x - \sigma_\phi)^2 + 4\tau^2} \right] \text{ or } \sqrt{(\sigma_x - \sigma_\phi)^2 + 4\tau^2}$$

2) When $\tau = 0$, S = largest absolute magnitude of either

$$S = \sigma_x, \sigma_\phi \text{ or } (\sigma_x - \sigma_\phi) .$$

WRC 297 contains slightly different indications, making no distinction for values of τ equal to or different from zero. Bulletin 537, although it is to be considered a copy of 107, actually indicates a different method that takes into consideration the sign of the σ involved.

Changes to these calculations are minor but can still result in stresses different than those calculated in the past. This change is retroactive, so it will also be visible on previous projects.