

## Calculo de conductos de una planta de Maaden en Ras al Khair, Arabia Saudi.

Cálculo con el programa SAP 2000 por el Método de los elementos finitos (MEF) de tuberías y conductos para una planta de fertilizantes de Maaden en Ras al Khair, Arabia Saudi

ALLOWABLE STRESS FOR ROUND DUCT ACCORD TO SMACNA "ROUND INDUSTRIAL DUCT CONSTRUCTION STANDARDS"	
<b>START-UP DATA</b>	
Duct diameter, D	203.0mm
Duct thickness, t	3.0mm
Material:	Carbon steel
Duct Class	3
Reduced thickness, t <sub>red</sub>	2.6mm
Steel quality:	A36
Steel yield strength, F <sub>y</sub>	248.0MPa
Young modulus, E	200000MPa
Poisson's ratio, ν	0.3
<b>DESIGN EQUATIONS</b>	
The allowable stress is obtained from the applicable expression:	
Equation 4-12a	Equation 4-12b
$\sigma_a = \frac{F_y}{\phi} \text{ for } D \leq \frac{C_1 \cdot R \cdot E}{\phi \cdot F_y}$	$\sigma_a = \frac{C_2 \cdot R \cdot E}{\phi \cdot D}$
<b>DESIGN PARAMETERS</b>	
Material factor, φ	0.333
Reduction factor for yield strength based on temperature, η <sub>1</sub>	1.000
Reduction factor for modulus of elasticity based on temperature, η <sub>2</sub>	1.000
Safety factor for bending moment applied to duct, D <sub>1</sub>	1.000
Safety factor for negative pressure applied to duct, D <sub>2</sub>	1.000
Ratio D/t	76.834
Ratio $(C_1 \cdot \eta_1 \cdot \eta_2) / (\phi \cdot F_y)$	237.253
<b>ALLOWABLE STRESS</b>	
Allowable stress design, σ <sub>a</sub>	82.7MPa
<b>MINIMUM WALL THICKNESS FOR POSITIVE PRESSURE</b>	
It has been determined that due to the high resistance to positive internal pressure exhibited by round duct, the practical fabrication limits described in sections 4.5 and 4.6 of "Round Industrial Ducts Construction Standards" are the more restrictive than the hoop strength necessary to withstand the highest duct pressure normally encountered in industrial work.	
<b>MINIMUM WALL THICKNESS FOR NEGATIVE PRESSURE WITHOUT CIRCUMFERENTIAL STIFFENERS</b>	
Equation 4-18	
$t = D \left[ \frac{p \cdot C_2 \cdot (1 - \nu^2)}{2 \cdot \eta_2 \cdot E} \right]$	
Negative pressure, p <sub>a</sub>	0.00135MPa
Minimum thickness for negative pressure, t <sub>min</sub>	0.46mm

