

Date _____ Calc. _____ Chkd. _____ Appr. _____

Software by SANT'AMBROGIO S.I. srl - Milano, Italy - EN Rev. 1.33-nMeB/aUs

CHECK OF TORISPHERICAL END POS.: 2

According to EN 13445-3 Ed. 2002 up to issue 21 (Clause 7 -8)

* Design temperature $T = 60.0 \text{ }^{\circ}\text{C}$
 * MATERIAL (Rec.Nr 119) SA 516 Gr. 60 PMA REQUIRED
 * NOMINAL DESIGN STRESS-DESIGN $f = 140.75 \text{ MPa}$
 * NOMINAL DESIGN STRESS-AT ROOM TEMPERATURE $fA = 147.33 \text{ MPa}$
 * NOMINAL DESIGN STRESS-HYDRAULIC TEST $f_{test} = 210.48 \text{ MPa}$
 Head outside diameter $De = 644.00 \text{ mm}$
 Inside spherical radius $R = 520.00 \text{ mm}$
 Corrosion allowance $c = 3.00 \text{ mm}$
 Knuckle inside radius $r = 100.00 \text{ mm}$
 Joint efficiency $z = 1.000$
 Adopted thickness $e = 10.00 \text{ mm}$
 Wall undertolerance $\delta = 0.000 \text{ mm}$
 Height of skirt $hc = 200.000 \text{ mm}$
 Thickness of skirt $ec = 10.000 \text{ mm}$

----- CHECK TO INTERNAL PRESSURE (EN 13445-3 Clause 7.5) -----

Design pressure $p' = 0.900 \text{ MPa}$
 Test pressure $pt' = 1.510 \text{ MPa}$
 Overpressure due to static head - Design $ph' = 0.000 \text{ MPa}$
 Overpressure due to static head - test $pht' = 0.000 \text{ MPa}$
 Calculation pressure - Design $p = ph' + p' = 0.900 \text{ MPa}$
 Calculation pressure - Test $pt = pht' + pt' = 1.510 \text{ MPa}$
 $Rp02t = 210.786 \text{ MPa}$
 $Rp02 = 221.000 \text{ MPa}$

* DESIGN :

$R' = R + c + \delta$ $R' = 523.00 \text{ mm}$
 $D' = De - 2 \cdot e + 2c + 2\delta$ $D' = 630.00 \text{ mm}$
 $es = p \cdot R' / (2 \cdot f \cdot z - 0.5 \cdot p) + c + \delta$ $= 4.67 \text{ mm}$
 $\beta = 0.7012$
 $ey = \beta \cdot p \cdot (.75 \cdot R' + .2 \cdot D') / f + c + \delta$ $= 5.32 \text{ mm}$
 $fb = Rp02t / 1.5$ $= 140.52 \text{ MPa}$
 $eb = (.75 \cdot R' + .2 \cdot D') \cdot (p / (111 \cdot fb) \cdot (D' / (r + c + \delta))^{.825})^{(1/1.5)} + c + \delta$ $= 5.10 \text{ mm}$

* TEST :

$R' = R + \delta$ $R' = 520.00 \text{ mm}$
 $D' = D - 2 \cdot e + 2\delta$ $D' = 624.00 \text{ mm}$
 $es = pt \cdot R' / (2 \cdot f_{test} - 0.5 \cdot pt) + c + \delta$ $= 1.87 \text{ mm}$
 $\beta = 0.6928$
 $ey = \beta \cdot pt \cdot (.75 \cdot R' + .2 \cdot D') / f_{test} + c + \delta$ $= 2.56 \text{ mm}$
 $fb_{test} = Rp02 / 1.05$ $= 210.48 \text{ MPa}$
 $eb = (.75 \cdot R' + .2 \cdot D') \cdot (pt / (111 \cdot fb_{test}) \cdot (D' / (r + \delta))^{.825})^{(1/1.5)} + \delta$ $= 2.27 \text{ mm}$

P_{max} (for simplified assessment of fatigue life - clause 17) $= 3.17 \text{ MPa}$
 Min. skirt thickness $= 5.02 \text{ mm}$

----- PRESSURES -----

MAX DESIGN PRESSURE - INTERNAL $= 3.17 \text{ MPa}$
 MAX TEST PRESSURE - INTERNAL $= 5.81 \text{ MPa}$
 - INTERNAL: $1.43 \cdot P'$ $= 1.287 \text{ MPa}$
 HEAD - INTERNAL: $1.25 \cdot P' \cdot fA / f$ $= 1.178 \text{ MPa}$