$t_{wall} := 10.5\ mm$

$t_{Max.minus} := 0.21\ mm$

$D_{Nominal.out} := 16\ in = 406.4\ mm$

$S := 448\ MPa$

$F := 0.90$

$E := 1.0$

$T := 1.0$

$$TP := \frac{2 \cdot \left(t_{wall} - t_{Max.minus} \right) \cdot S \cdot F \cdot E \cdot T}{D_{Nominal.out}} = 204.1795\ bar$$

a) Hydrostatic Test Pressure Calculation

If the test pressure is required to give a hoop stress of 90 % OR 95 % of SMYS based on minimum wall thickness, it should be calculated as follows:

$$TP = \frac{2 \times (t_{min}) \times S \times F \times E \times T}{D_o}$$

Where,

TP	=	Hydrostatic strength test pressure	MPa (g)
tmin	=	specific minimum wall thickness of pipe (i.e. nominal wall thickness less maximum negative tolerance)	m
Do	=	nominal outside diameter of pipe	m
S	=	Specified Minimum Yield Strength (SMYS)	Mpa
F	=	Design factor (for hydrostatic strength test, i.e. 90% stress level, F = 0.90)	
E	=	Longitudinal joint factor (for linepipe in accordance with DEP 31.40.20.37-Gen., E = 1.0)	
T	=	Temperature derating factor (for hydrostatic strength test, T = 1.0)	

$SMYS := 448\ \text{MPa}$

$TP_{min} := 90\ \% \cdot SMYS = 4032\ \text{bar}$

$$10.4132\ \text{mm} > 7.557\ \text{mm} = 1$$

Approx. Value

$L_{DataSum} := 5.169\ \text{km} = 5169\ \text{m}$

Exact Value

$L_{TestPack} := 5118.170\ \text{m}$

$ID := 385.4\ \text{mm}$

$$PV_1 := \frac{\pi \cdot ID^2 \cdot \left(L_{DataSum}\right)}{4} = 603.0035\ \text{m}^3$$

$$PV_2 := \frac{\pi \cdot ID^2 \cdot \left(L_{TestPack}\right)}{4} = 597.0738\ \text{m}^3$$

Error Percentage

$$\frac{PV_1 - PV_2}{PV_2} \cdot 100 = 0.9931$$

The error % is less than 1%; therefore negligible