



## Reinforcement of Branch Connection Verification

PREPARED: **P.G.A.Engineering**

CHECKED:

APPROVED:

DATE: 4 settembre 2010

This calculation is according to ASME B31.4-2002

Outside Diameter of Header Pipe	16				
Schedula Number of Header Pipe	XS				
Header Pipe Material	API 5L Gr.X52				
Weld Joint Factor of Header Pipe	Seamless				
Outside Diameter of Branch Pipe	6				
Schedula Number of Branch Pipe	S				
Branch Pipe Material	A694 Gr.F52				
Weld Joint Factor of Branch Pipe	Seamless				
Design Pression	P	98	bar		
Test Pression	P <sub>TEST</sub>	115,0	bar		
Maximum Temperature	T <sub>MAX</sub>	38	°C		
Minimum Temperature	T <sub>MIN</sub>	0	°C		
Test Temperature	T <sub>TEST</sub>	20	°C		
Trading, Grooving and Corrosion Allowance	c	2,0	mm		
Weldolet or Nipolets Height	H	60,5	mm		
Weldolet or Nipolets Exthernal Diameter	d <sub>R</sub>	210,21	mm		
Weldolet or Nipolets Chamfer Height	C <sub>R</sub>	20,955	mm		

### CALCULATION

DESCRIPTION	DEF.	Imperial		Metric	
		Values	Unit of Measure	Values	Unit of Measure
<b>INPUT</b>					
Outside Diameter of Header Pipe	D	16,000	in	406,40	mm
Header Pipe Wall Thickness	T <sub>h</sub>	0,500	in	12,70	mm
Outside Diameter of Branch Pipe	d	6,626	in	168,30	mm
Branch Pipe Wall Thickness	T <sub>b</sub>	0,280	in	7,11	mm
Corrosion Allowance	c	0,079	in	2	mm
Design Pressure	P	1421	psi	9,80	MPa
Design Pressure at Test Temperature	P <sub>TEST</sub>	1668	psi	11,50	MPa
Maximum Temperature	T <sub>MAX</sub>	100,4	°F	38	°C
Minimum Temperature	T <sub>MIN</sub>	32	°F	0	°C
Test Temperature	T <sub>TEST</sub>	68	°F	20	°C
Header Pipe Weld Joint Factor	E <sub>h</sub>	1,0	-	1,0	-
Allowable Pipe Stress at Operating Condition	S <sub>h,OP</sub>	37440	psi	258	MPa
Allowable Pipe Stress at Test Temperature	S <sub>h,TEST</sub>	37440	psi	258	MPa
Joint Efficiency Factor	E <sub>b</sub>	1,0	-	1,0	-
Allowable Pipe Stress at Operating Condition	S <sub>b,OP</sub>	37440	psi	258	MPa
Allowable Pipe Stress at Test Temperature	S <sub>b,TEST</sub>	37440	psi	258	MPa



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DESCRIPTION	DEF.	Imperial		Metric	
		Values	Unit of Measure	Values	Unit of Measure

### OUTPUT

Minimum Header Thickness at Operating Condition	$t_{h,OP}$	0,304	in	7,71	mm
Minimum Header Thickness at Test Condition	$t_{h,TEST}$	0,356	in	9,05	mm
Minimum Header Pipe Thickness Required	$t_h$	0,435	in	11,05	mm
Minimum Header Pipe Thickness Garanteed	$t_{h,G}$	0,438	in	11,11	mm
Minimum Branch Thickness at Operating Condition	$t_{LS,OP}$	0,126	in	3,19	mm
Minimum Branch Thickness at Test Condition	$t_{LS,TEST}$	0,148	in	3,75	mm
Minimum Branch Pipe Thickness Required	$t_b$	0,226	in	5,75	mm
Minimum Branch Pipe Thickness Garanteed	$t_{b,G}$	0,245	in	6,22	mm
Required Area Coefficient	K	0,876	-	0,88	-
Maximum Height of the Reinforcement Zone	L	1,781	in	45,2438	mm
Maximum Half-Width of the reinforcement Zone	$r_1$	6,066	in	154,08	mm
Reinforcement Area Required	A	2,339	in <sup>2</sup>	1509,15	mm <sup>2</sup>
Area Resulting from an excess $t_h$ in Header Pipe	$A_1$	0,015	in <sup>2</sup>	9,36	mm <sup>2</sup>
Area Resulting from an excess $t_h$ in Branch Pipe	$A_2$	0,066	in <sup>2</sup>	42,75	mm <sup>2</sup>
Additional Reinforcement Area Required	$A_3$	2,25842	in <sup>2</sup>	1457,04	mm <sup>2</sup>
Minimum Nipolets Exthernal Diameter	$d_{R,MIN}$	8,28	in	210,210	mm
Maximum Chamfer Height	$C_{R,MAX}$	0,82	in	20,955	mm
Effective Reinforced Area Added	$A_{3,EFF}$	2,25842	in <sup>2</sup>	1457,04	mm <sup>2</sup>

### Weldolet or Nipolets Dimension

Weldolet or Nipolets Height	H	2,38	in	60,50	mm
Weldolet or Nipolets Exthernal Diameter	$d_R$	8,28	in	210,21	mm
Chamfer Height	$C_R$	0,83	in	20,96	mm

### VERIFICATION

Description	Formula	CHECK
Header Pipe Minimum Thickness Verification	$t_{h,G} \geq t_h$	VERO
Branch Pipe Minimum Thickness Verification	$t_{b,G} \geq t_b$	VERO
Temperature Condition Applicability	$T_{MIN} \geq -20^{\circ}F ; T_{MAX} \leq 250^{\circ}C$	VERO
Height of Reinforment Zone	$H \geq L$	VERO
Width of Reinforment Zone	$d_R \leq 2 r_1$	VERO
Diameter Verification	$d_R \geq d_{R,MIN}$	VERO
Chamfer Verification	$C_R \leq C_{R,MAX}$	VERO
Reinforced Area Verification	$A_{3,EFF} \geq A_3$	VERO