

REGISTRATION OF A PRESSURE FITTING DESIGN

16-Nov-22

TSSA
345 Carlingview Drive
Toronto, Ontario
M9W 6N9

Attention: Tanya Francis

File Number: 13349 [0 F]

Re: Manufacturer: Headline Filters Ltd.
Item: 180VP Filter
Catalog or Drawing: Scope of Registration (15-Apr-22) & Design Report R-1473 Rev. 0

TSASK Codes and Standards Compliance has registered the design listed above in accordance with The Boiler and Pressure Vessel Act and Regulations and CSA B51. The Canadian Registration Number (CRN) is:

0E7432.13 Expiry Date: April 29, 2032

Please note that every fitting shall be constructed in strict accordance with the registered design.

Fitting registrations are required to be resubmitted for validation after ten (10) years from the registration date in accordance with CSA B51, Clause 4.2.1.

Should you require anything further, please do not hesitate to contact the Codes and Standards Compliance Office at your convenience.

Yours truly,



Athan Syrgiannis, P.Eng.
Codes and Standards Compliance

Remarks:

A valid quality control program must be maintained at the production facility for the fitting registration to remain valid until the expiry date.

Statutory Declaration (Registration of Fittings)

TSK-1008

I. Declaration Information

I, Scott Hardiman
Works Manager
(company title, e.g. vice president, plant manager, chief engineer)
(must be in a position of authority in the manufacturing plant where the fitting is produced)

In this space, show facsimile of manufacturer's logo or trademark as it will appear on the fitting.

of: Headline Filters Limited
(name of manufacturer)



located at: Mill Hall Business Estate, Aylesford, United Kingdom ME20 7JZ
(Plant Address – Apt/Street) (City,Prov) (Postal Code)

do solemnly declare that the fittings listed hereinunder, which are subject to the **Saskatchewan Boiler and Pressure Vessel Safety Act** (check one)

- Comply with the requirements of ASME B31.3 which specifies the dimensions, (title of recognized North American Standard) Materials of construction, pressure / temperature ratings and identification marking of the fittings, or
- Are not covered by the provisions of a recognized North American standard and are therefore manufactured to comply with _____ as supported by the attached data which identifies the dimensions, materials of construction, pressure / temperature ratings and the basis for such ratings, and the marking of the fittings for identification.

I further declare that the manufacturer of these fittings is controlled by a quality control program which has been verified by the following authority, BSI ISO 9001:2015 as being suitable for the manufacturer of these fittings to the stated standard. The fittings covered by this declaration, for which I seek registration, are CATEGORY E - FILTERS

In support of this application, the following information, calculations and / or test data are attached:
SCOPE OF CRN REGISTRATION, REPORTS, DRAWINGS, CALCULATIONS

II. Declaration

DECLARED before me at 16 Mill Street, Maidstone In the County of Kent
this 28th day of February, 2022
Alexander Gwilum Astley (print name) [Signature] (Signature)
[Signature] (Signature of Commissioner of Oaths)

III. Office Use Only

To the best of my knowledge and belief, the fitting complies with the requirements of the **CSA B51, Clause 4.2**, and is accepted for registration.
(Registration Number)



Technical Safety Authority of Saskatchewan
Registration No. 0E7432.13
File No. 13349
Registered
Date: November 16, 2022
Expiry Date: April 29, 2032
Codes & Standards Compliance Office

under the **Boiler and Pressure Vessel Safety Act** and
_____ (Expiry Date – MM DD YYYY)
_____ (Inspector)

Alexander Gwilum Astley
16 Mill Street
Maidstone, Kent. ME15 6XT
Tel: 01622 678341
Notary Public



HEADLINE FILTERS LTD

UNIT 1-2 MILL HALL BUSINESS ESTATE
AYLESFORD, KENT
ME20 7JZ, UNITED KINGDOM

15-Apr-22



PAGE 1 OF 1

SCOPE OF CRN REGISTRATION

Product Description	GA Drawings	Design Code	Material Specification	Process Connections	MAWP at MAWT (psig at °F)	MDMT	Report Number
180VP Filter	HF4/4642, HF4/4607, HF4/4650, HF4/4616	ASME B31.3	Stainless Steel ASTM A479-316/316L, ASTM A182-F316/F316L	NPT: 1/4", 1/2", 3/4", 1" SAE: 4 ,6 ,8 ,12, 16	4700 psig at 400°F/ 324 barg at 204°C	-320°F / -196°C	R-1473 Rev. 0

Note 1: MAWP = Maximum Allowable Working Pressure, MAWT = Maximum Allowable Working Temperature, MDMT = Minimum Design Metal Temperature

Note 2: The pressure-temperature ratings shown are the maximum CRN pressure-temperature ratings. In all cases the MAWP may be limited by the seat or seal material or other considerations. Please consult Headline Filters literature.

Note 3: For low temperature operation the products shall conform to the rules of the applicable codes under which they are used.

A registration stamp from the Technical Safety Authority of Saskatchewan. It includes a grid logo, registration details, and a 'Registered' status box.

Technical
Safety Authority
of Saskatchewan

Registration No. 0E7432.13

File No. 13349

Registered

Date: November 16, 2022

Expiry Date: April 29, 2032

Codes & Standards Compliance Office

DESIGN REPORT IN ACCORDANCE WITH ASME B31.3, 2020

Product Description: **180VP Filter**
 Main Drawing: See "Manufacturing Program" Section of this Report (*Note 1*)
 Process Connections: NPT: 1/4", 1/2", 3/4", 1"
 SAE: 4, 6, 8, 12, 16
 Materials of Construction: Stainless Steel ASTM A479-316/316L, ASTM A182-F316/F316L
 Max Design Conditions: 324 barg at 204°C / 4700 psig at 400°F
 MDMT: - 196°C / - 320°F
 Corrosion Allowance: NIL
 Mechanical Allowance: NIL
 NDE: None
 PWHT: None

Technical Safety Authority of Saskatchewan
 Registration No. 0E7432.13
 File No. 13349
 Registered
 Date: November 16, 2022
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Note 1: See Appendix A for Manufacturing Drawings

DESCRIPTION OF PRODUCT

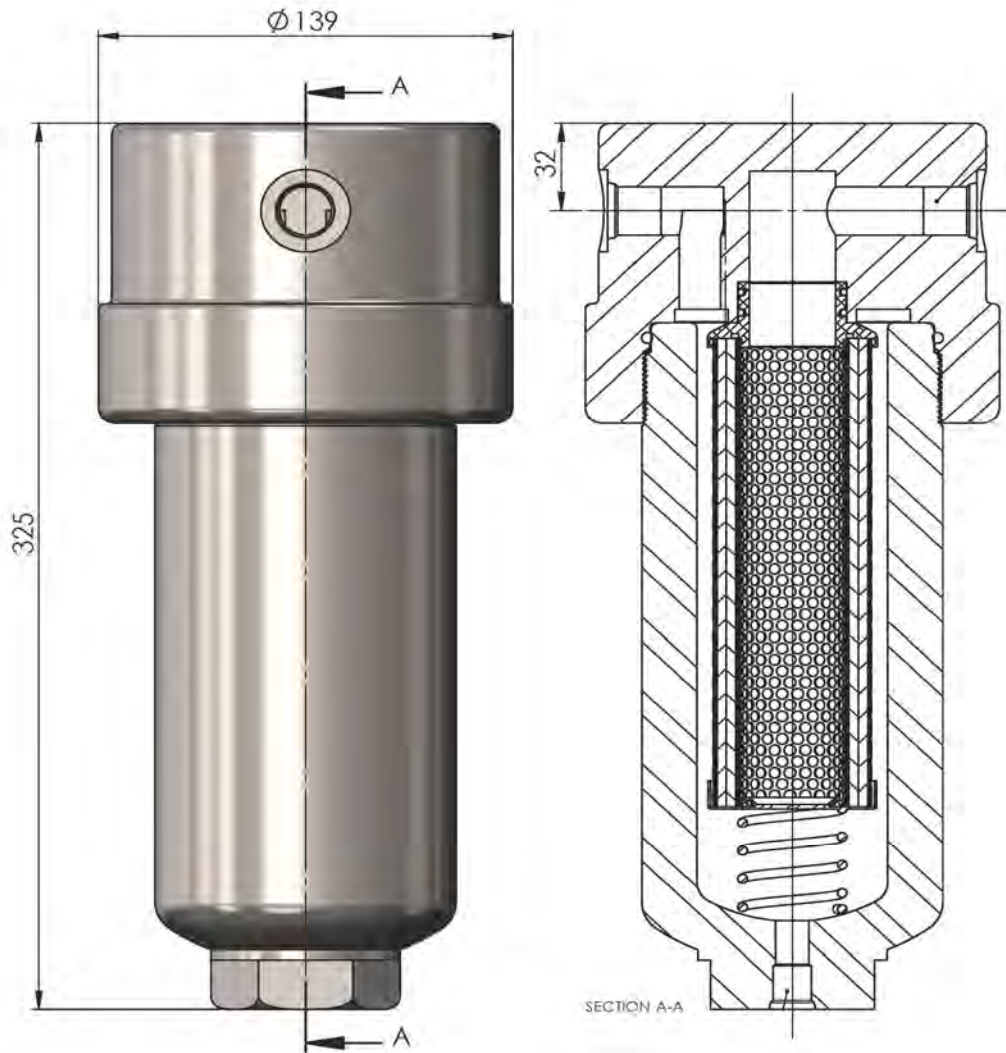


Figure 1.0

Headline housings are suitable for liquids and gases, these housings are ideal for high flow corrosive applications.

MANUFACTURING PROGRAM

SAE Head Options		16	12	8	SAE Head Options		16	12	8
Regular Bowl Length 38-172-Element Option		GA Numbers			Regular Bowl Length 38-381-Element Option		GA Numbers		
SAE Drain Options	8	HF4/4650	HF4/4650	HF4/4650	SAE Drain Options	8	HF4/4616	HF4/4616	HF4/4616
	6	HF4/4650	HF4/4650	HF4/4650		6	HF4/4616	HF4/4616	HF4/4616
	4	HF4/4650	HF4/4650	HF4/4650		4	HF4/4616	HF4/4616	HF4/4616
	Blank	HF4/4650	HF4/4650	HF4/4650		Blank	HF4/4616	HF4/4616	HF4/4616

NPT Head Options		1"	3/4"	1/2"	NPT Head Options		1"	3/4"	1/2"
Regular Bowl Length 38-172-Element Option		GA Numbers			Regular Bowl Length 38-381-Element Option		GA Numbers		
NPT Drain Options	1/2"	HF4/4642	HF4/4642	HF4/4642	NPT Drain Options	1/2"	HF4/4607	HF4/4607	HF4/4607
	1/4"	HF4/4642	HF4/4642	HF4/4642		1/4"	HF4/4607	HF4/4607	HF4/4607
	Blank	HF4/4642	HF4/4642	HF4/4642		Blank	HF4/4607	HF4/4607	HF4/4607

= Item Proof Tested in accordance with UG-101 of ASME Section VIII-1. **See Report Section 1.0**

The head dimensions are identical for all process connections. The only item that changes is the process connection size and type.

The bowl dimensions are identical for all process connections. The only item that changes is the drain size and type and the bowl length.

A sample of the component drawings that are provided with this report as shown below:

Sample Component Drawings Provided with Report	
180VP Head SAE16	HF4/4252
180VP Head SAE12	
180VP Head SAE8	HF4/4522
180VP Bowl (reg) SAE8	
180VP Bowl (reg) SAE6	HF4/4257
180VP Bowl (reg) SAE4	
180VP Bowl (reg) Blank	
180VP Bowl (long) SAE8	
180VP Bowl (long) SAE6	
180VP Bowl (long) SAE4	
180VP Bowl (long) Blank	

180VP Head 1" NPT	HF4/4251
180VP Head 3/4" NPT	
180VP Head 1/2" NPT	
180VP Bowl (reg) 1/2" NPT	
180VP Bowl (reg) 1/4" NPT	HF4/4256
180VP Bowl (reg) Blank	
180VP Bowl (long) 1/2" NPT	
180VP Bowl (long) 1/4" NPT	
180VP Bowl (long) Blank	

ALLOWABLE STRESS

Material:

Allowable Stress Values @	100	F=	16,700 psi, Stress Value from ASME B31.3 Table A-1
Allowable Stress Values @	400	F=	15,500 psi, Stress Value from ASME B31.3 Table A-1
Yield Stress @	100	F=	25,000 psi, Stress Value from ASME B31.3 Table A-1
Tensile Stress @	100	F=	70,000 psi, Stress Value from ASME B31.3 Table A-1
Min Temp. =			-425F

ASME B31.3 Stainless Steel ASTM A182-F316L

Material:

Allowable Stress Values @	100	F=	16,700 psi, Stress Value from ASME B31.3 Table A-1
Allowable Stress Values @	400	F=	15,700 psi, Stress Value from ASME B31.3 Table A-1
Yield Stress @	100	F=	25,000 psi, Stress Value from ASME B31.3 Table A-1
Tensile Stress @	100	F=	70,000 psi, Stress Value from ASME B31.3 Table A-1
Min Temp. =			-425F

ASME B31.3 Stainless Steel ASTM A479-316

Material:

Allowable Stress Values @	100	F=	20,000 psi, Stress Value from ASME B31.3 Table A-1
Allowable Stress Values @	400	F=	19,300 psi, Stress Value from ASME B31.3 Table A-1
Yield Stress @	100	F=	30,000 psi, Stress Value from ASME B31.3 Table A-1
Tensile Stress @	100	F=	75,000 psi, Stress Value from ASME B31.3 Table A-1
Min Temp. =			-325F

ASME B31.3 Stainless Steel ASTM A182-F316

Material:

Allowable Stress Values @	100	F=	20,000 psi, Stress Value from ASME B31.3 Table A-1
Allowable Stress Values @	400	F=	19,300 psi, Stress Value from ASME B31.3 Table A-1
Yield Stress @	100	F=	30,000 psi, Stress Value from ASME B31.3 Table A-1
Tensile Stress @	100	F=	75,000 psi, Stress Value from ASME B31.3 Table A-1
Min Temp. =			-325F

DESIGN CALCULATIONS AND DATA

In accordance with ASME B31.3 para. 302.2.3 components not listed in Table 326.1 may be used subject to all of the following requirements.

- (a) The material shall comply with para. 323.
- (b) The designer shall be satisfied that the design is suitable for the intended service.
- (c) Pressure-temperature ratings shall be established in accordance with the rules in para. 304.

Therefore, in order to satisfy the requirements of ASME B31 codes proof testing in accordance with UG-101 of ASME Section VIII-1 has been performed along with ASME B31.3 code calculations.

REPORT SECTION	DESCRIPTION	PAGE NO.
1	ASME Section VIII-1 UG-101 Proof Test	5
2	Filter Housing Top of Bowl - ASME B31.3 Pipe	7
3	Filter Housing Head - ASME B31.3 Pipe	8
4	Filter Housing Head Thickness	9
5	Filter Housing Head Thickness - Center Passageway	10
6	Filter Housing Lower Bowl Head Thickness	11
7	Head to Bowl Connection - Thread Shear	12
8	Process Connections - Thread Shear	13
9	NPT Process Connections	15
10	Strength of Branch / Process Connections	15

1/ Proof Test in accordance with Part UG-101 of ASME Section VIII-1

1.1/ SAMPLES TESTED

Testing was performed on a **Regular Bowl 38-172 Length Filter with 1" NPT process inlet and outlet connections and a 1/2" NPT drain.**

The filter was tested with the largest available process connections which justifies the smaller available process connections. See "Manufacturing Program" section of this report.

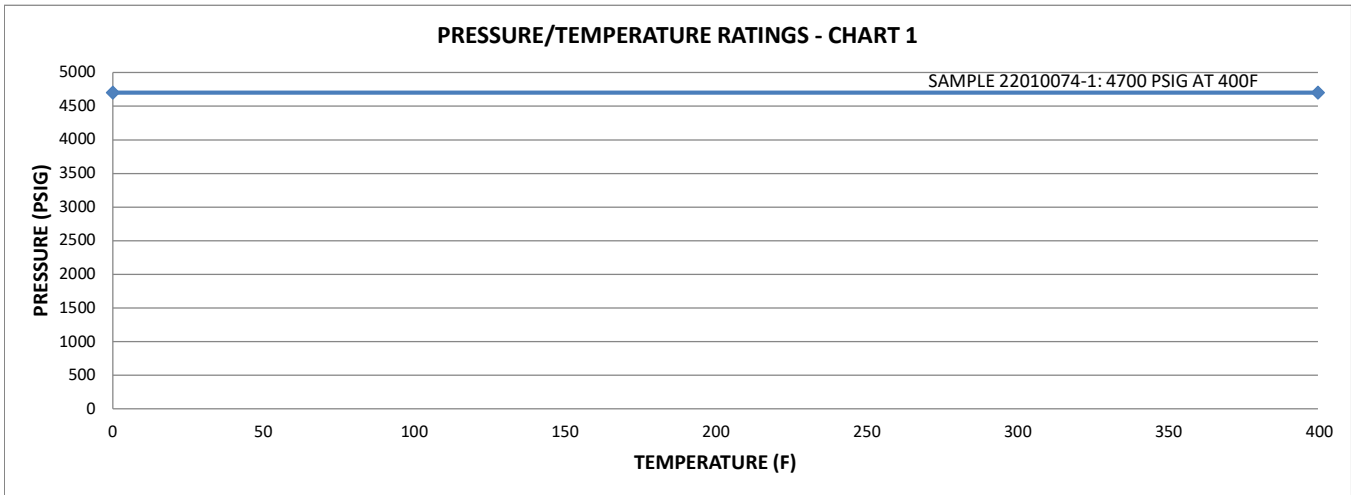
In addition the only difference between the 38-172 filters and the 38-381 filters is the bowl length.

Therefore, for configurations not tested justification is based on the results of the other sizes by referencing ASME Section VIII-1, "Rules for Construction of Pressure Vessels", Part UG101(d) Duplicate or similar parts.

In addition ASME B31.3 para. 304.7.2(e) states when proof testing is performed the designer may interpolate between sizes, wall thicknesses, and pressure classes, and may determine analogies among related materials.

1.2/ SECTION UG-101(M) CALCULATIONS

It is required that the product satisfy the requirements of UG-101 resulting in the following maximum allowable working pressure's (MAWP) at the following design temperatures.



To determine the required burst test pressure to satisfy the above MAWP at the above design temperatures the requirements of UG-101(k) apply. In accordance with the requirements of UG-101(k) the maximum allowable working pressure for vessels or parts that are to operate at temperatures at which the allowable stress value of the material is less than at the test temperature shall be determined by the following formula:

$$P_o = P_t \cdot (S/S_2)$$

Samples: **22010074-1**
 Material: **ASME B31.3 Stainless Steel ASTM A479-316**
 where;
 $P_o = 4700$ psig, MAWP at the design temperature
 $P_t =$ psig, MAWP at test temperature
 $S = 19300$ psi, Maximum allowable stress value at the design temperature
 $S_2 = 20000$ psi, Maximum allowable stress value at the test temperature

Solving for P_t the results are:

$$P_t = 4870.47 \text{ psig, MAWP at test temperature or MAWP at } 100 \text{ F}$$

In accordance with UG-101(m)(1) the burst test may be stopped at any pressure before rupture that will satisfy the requirements for the desired maximum allowable working pressure.

In accordance with UG-101(m)(2)(a) the MAWP of parts constructed of materials other than cast materials is determined as follows:

$$P = (B/4) \cdot (S_u E / S_{uavg}) \quad \text{or} \quad P = (B/4) \cdot (S_u E / S_{ur})$$

Option A *Option B*

where;

P = psig, MAWP

B = psig, Bursting Pressure, or hydrostatic test pressure at which the test was stopped

E = efficiency of welded joint, if used (No welded joints = 1, Welded Joints between Seamless Components = 0.85)

Su = psi, specified minimum tensile strength at room temperature.

Suavg = psi, average actual tensile strength of test specimens at room temperature

Sur = psi, maximum tensile strength of range of specification at room temperature.

The values of Suavg or Sur are determined from the pressure retaining components MTR's and materials specifications.

Sample	Item	Material	Minimum Tensile Strength per Specification, Su (Mpa)	Actual Tensile Strength (Mpa)		Suavg/Su
				Tensile's	Suavg	
22010074-1	Head	ASTM A479-316	515	547 559 551 572	557	1.08
	Bowl	ASTM A479-316	515	572	572	1.11

A Copy of the Material Test Reports (MTR) can be found in **Appendix B**.

Therefore, to be conservative use the largest Suavg/Su value in the calculations. This value is 1.11

Therefore, the required burst pressure is calculated by the formula:

$$B = 4 \times P_x (Su_{avg}/SuE)$$

The following table summarizes the required burst test pressure to satisfy the required MAWP.

Sample	P = Pt = Calculated MAWP at 100 F (psig)	Suavg/Su	E	B - Calculated Minimum Burst Pressure (psig) at 100 F.
22010074-1	4870.47	1.11	1	21625

1.3/ TEST RESULTS

Proof testing was witnessed by a National Board Inspector. See **Appendix C** for proof test results.

The results of the proof test show

Sample	Burst Pressure (psig)	Required MAWP at Test Temperature (Pt)(psig)	Burst CRN factor (X)	Failure Mode
21010542-1	21943	4870.47	4.51	Thread Shear

Note: Burst CRN factor based on UG-101(k) calculated MAWP at test temperature.

Therefore, since the actual burst pressure exceeds the calculated minimum burst pressure the item is suitable for the design conditions stated.

2/ Filter Housing Top of Bowl - ASME B31.3 PIPE (Straight Pipe under Internal Pressure)

The sections of the component with the smallest t/D ratio, where t = wall thickness and D = outside diameter, has been explored to ensure compliance with ASME B31.3. This area is the thickness under the groove.

The required thickness of straight sections of pipe shall be determined in accordance with equation (2) of section 304.1.1(a), where:

eq. (2) $t_m = t + c$

Where;

t_m = minimum required thickness

t = pressure design thickness

c = 0.02 in, sum of mechanical allowances plus corrosion and erosion allowances

Note: If wall thickness tolerance not specified you may assume c = 0.02" per ASME B31.3 paragraph 304.1.1.

The internal pressure design thickness for straight pipe shall be not less than that calculated in accordance with either eq. (3a) or eq. (3b)

eq. (3A) $t = (PD)/(2(SEW+PY))$

Therefore, The maximum internal Design Pressure can be calculated as

$P = (2(t_{actual}-c)/D)(SEW)/(1-2(t_{actual}-c)y/D)$

eq. (3b) $t = (P(d+2c))/(2[(SEW)-P(1-y)])$

Therefore, The maximum internal Design Pressure using equal (3b) can be calculated as

$P = t_{actual}(2SEW)/(d+2c+2t_{actual}(1-y))$

Where;

P = 4700 psig, Max. Internal Design Gage Pressure.

P Rated = 4700 psig, Maximum Rated Pressure per Manufacturer.

T Rated = 400 F

D = OD = in., Outside Diameter

d = ID = in., Inside Diameter. For pressure design calculation, the inside diameter of the pipe is the maximum value allowable under the purchase specification.

t actual = in., Actual thickness minus mill and mechanical allowance (Variable T in ASME B31.3 para. 304.1.1)

S = 19,300 psi, Basic Allowable Stress Value **ASME B31.3 Stainless Steel ASTM A479-316**

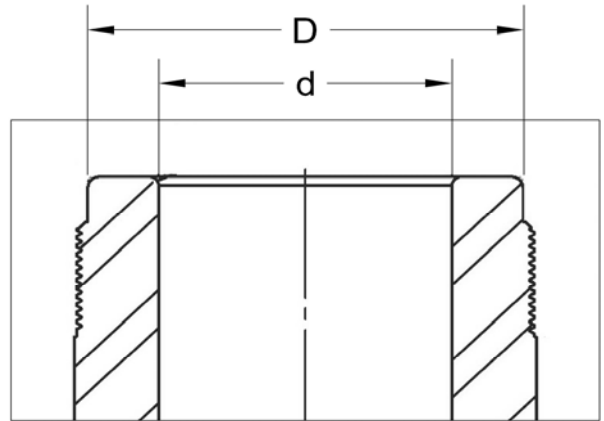
E = 1.00 Quality factor

W = 1 Weld Joint Reduction Factor in accordance with para. 302.3.5(e).

y = For $t \geq D/6$, $Y = (d+2c)/(D+d+2c)$

For $t < D/6$, $Y = 0.4$

P/SE = 0.244 < 0.385 Acceptable



The results of the calculations are as follows:

Description	D in.	d in.	D/6	t actual in.	y	P(3a) psig.	P(3b) psig.	P Rated psig	
Bowl	3.740	2.520	0.623	0.6100	0.40	6969	6969	4700	Acceptable
t (3a) in.	t (3b) in.	c in.	tm (3a) in.	tm (3b) in.					
0.4150	0.3650	0.0200	0.4350	0.3850					Acceptable

In all cases P rated is less than P, therefore the component is suitable for the design conditions stated.

3/ Filter Housing Head - ASME B31.3 PIPE (Straight Pipe under Internal Pressure)

The sections of the component with the smallest t/D ratio, where t = wall thickness and D = outside diameter, has been explored to ensure compliance with ASME B31.3. This area is the thickness under the groove.

The required thickness of straight sections of pipe shall be determined in accordance with equation (2) of section 304.1.1(a), where:

eq. (2) $t_m = t + c$

Where;

t_m = minimum required thickness

t = pressure design thickness

c = 0.02 in, sum of mechanical allowances plus corrosion and erosion allowances

Note: If wall thickness tolerance not specified you may assume c = 0.02" per ASME B31.3 paragraph 304.1.1.

The internal pressure design thickness for straight pipe shall be not less than that calculated in accordance with either eq. (3a) or eq. (3b)

eq. (3A) $t = (PD)/(2(SEW+PY))$

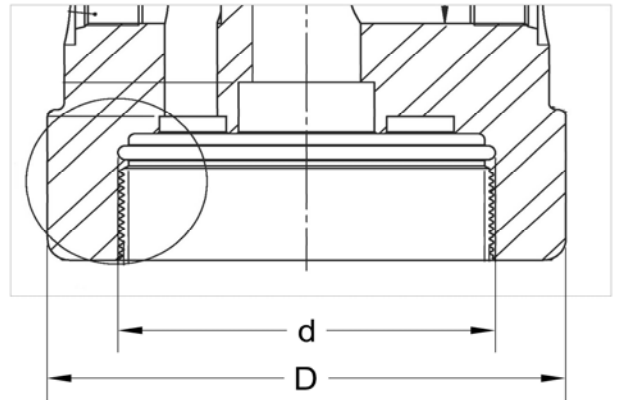
Therefore, The maximum internal Design Pressure can be calculated as

$P = (2(t_{actual}-c)/D)(SEW)/(1-2(t_{actual}-c)y/D)$

eq. (3b) $t = (P(d+2c))/(2[(SEW)-P(1-y)])$

Therefore, The maximum internal Design Pressure using equal (3b) can be calculated as

$P = t_{actual}(2SEW)/(d+2c+2t_{actual}(1-y))$



Where;

P = 4700 psig, Max. Internal Design Gage Pressure.

P Rated = 4700 psig, Maximum Rated Pressure per Manufacturer.

T Rated = 400 F

D = OD = in., Outside Diameter

d = ID = in., Inside Diameter. For pressure design calculation, the inside diameter of the pipe is the maximum value allowable under the purchase specification.

t actual = in., Actual thickness minus mill and mechanical allowance (Variable T in ASME B31.3 para. 304.1.1)

S = 19,300 psi, Basic Allowable Stress Value

ASME B31.3 Stainless Steel ASTM A479-316

E = 1.00 Quality factor

W = 1 Weld Joint Reduction Factor in accordance with para. 302.3.5(e).

y = For $t \geq D/6$, $Y = (d+2c)/(D+d+2c)$

For $t < D/6$, $Y = 0.4$

P/SE = 0.244 < 0.385 Acceptable

The results of the calculations are as follows:

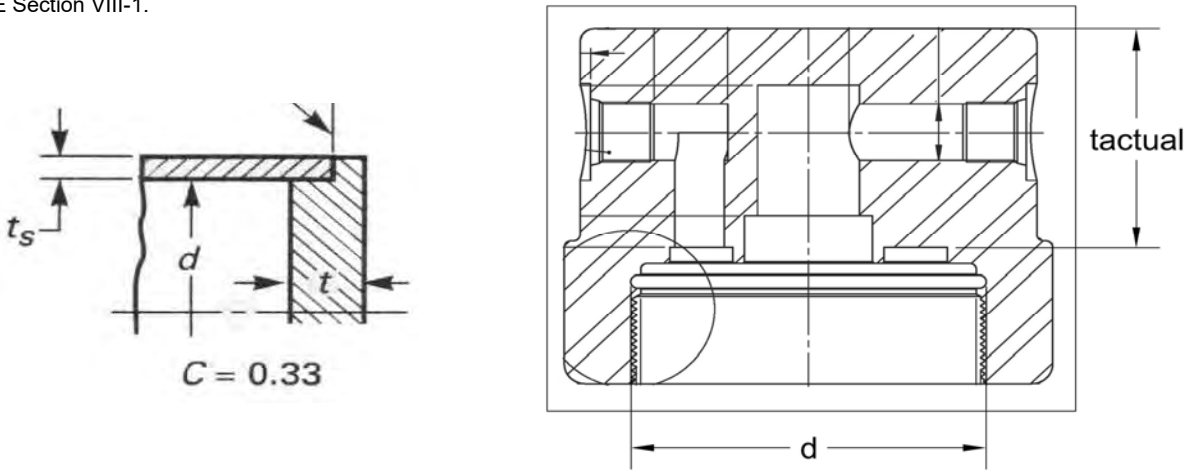
Description	D in.	d in.	D/6	t actual in.	y	P(3a) psig.	P(3b) psig.	P Rated psig	
Bowl	5.472	3.984	0.912	0.7440	0.40	5712	5712	4700	Acceptable
t (3a) in.	t (3b) in.	c in.	tm (3a) in.	tm (3b) in.					
0.6071	0.5738	0.0200	0.6271	0.5938					Acceptable

In all cases P rated is less than P, therefore the component is suitable for the design conditions stated.

4/ Filter Housing Head Thickness

In accordance with section 304.4.1(b) of **ASME B31.3** closures may be designed in accordance with the rules in the BPV Code, Section VIII-1.

To determine the minimum head thickness calculations have been performed in accordance with UG-34 of ASME Section VIII-1.



It was chosen to treat the closure as equivalent to that shown in **Figure UG-34(h)**

The minimum required thickness of flat unstayed circular heads shall be calculated by the formula:

$$t = d \cdot (CP/SE)^{0.5} + c$$

Therefore, The maximum internal Design Pressure can be calculated as

$$P = ((t_{actual} - c)/d)^2 (SE/C)$$

where;

- t= [redacted] in., Minimum required thickness of flat head or cover
- tactual = [redacted] in., Actual Minimum Thickness
- d = [redacted] in., Maximum Dia., or short span, measured as indicated in Fig. UG-34.
- C = 0.33 factor in accordance with UG-34
- P= 4700 psig, Internal Design Pressure
- Pmax = [redacted] psig, Maximum possible rated pressure
- S = 19,300 psi, Basic Allowable Stress Value **ASME B31.3 Stainless Steel ASTM A479-316**
- E = 1.00 Joint Efficiency
- c = 0.02 in., Corrosion Allowance

The results of the calculations are as follows

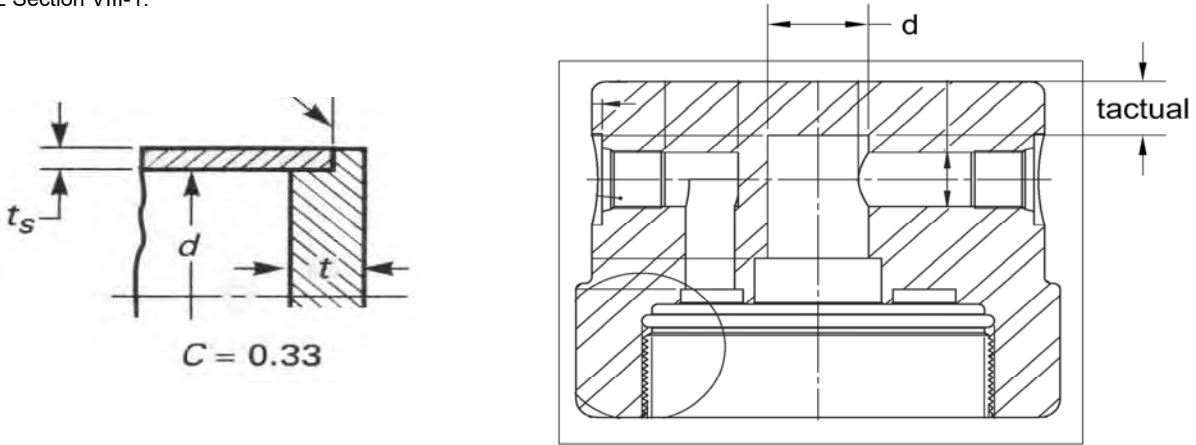
Description	d max (in.)	t (in.)	tactual (in.)	P max (psig)
Head	3.984	1.149	2.677	26013

The actual thickness exceeds the required therefore the thickness is acceptable.

5/ Filter Housing Head Thickness - Center Passageway

In accordance with section 304.4.1(b) of **ASME B31.3** closures may be designed in accordance with the rules in the BPV Code, Section VIII-1.

To determine the minimum head thickness calculations have been performed in accordance with UG-34 of ASME Section VIII-1.



It was chosen to treat the closure as equivalent to that shown in **Figure UG-34(h)**

The minimum required thickness of flat unstayed circular heads shall be calculated by the formula:

$$t = d \cdot (C \cdot P / S E)^{0.5} + c$$

Therefore, The maximum internal Design Pressure can be calculated as

$$P = ((t_{actual} - c) / d)^2 (S E / C)$$

where;

- t = [redacted] in., Minimum required thickness of flat head or cover
- tactual = [redacted] in., Actual Minimum Thickness
- d = [redacted] in., Maximum Dia., or short span, measured as indicated in Fig. UG-34.
- C = 0.33 factor in accordance with UG-34
- P = 4700 psig, Internal Design Pressure
- Pmax = [redacted] psig, Maximum possible rated pressure
- S = 19,300 psi, Basic Allowable Stress Value
- E = 1.00 Joint Efficiency
- c = 0.02 in., Corrosion Allowance

ASME B31.3 Stainless Steel ASTM A479-316

The results of the calculations are as follows

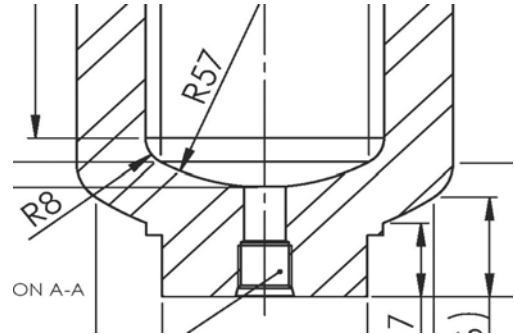
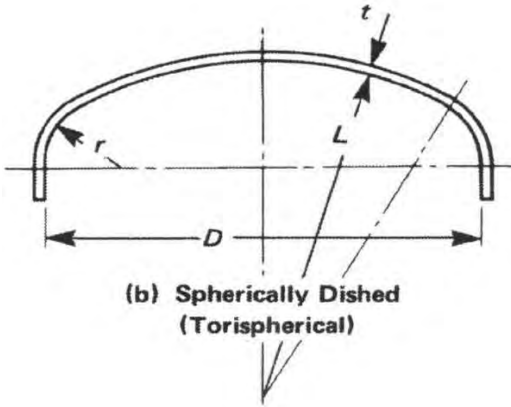
Description	d max (in.)	t (in.)	tactual (in.)	P max (psig)
Head	1.142	0.3437	0.690	20131

The actual thickness exceeds the required therefore the thickness is acceptable.

6/ Filter Housing Lower Bowl Head Thickness

In accordance with section 304.4.1(b) of **ASME B31.3** closures may be designed in accordance with the rules in the BPV Code, Section VIII-1.

The minimum thickness of spherically dished heads shall be calculated by formula (3) given in Appendix 1-4(d) of ASME Section VIII-1.



eq. (3) ASME SECTION VIII-1: $t = (PLM)/(2SE-0.2P)$ or $P = (2SEt)/(LM+0.2t)$

Where;

- t = [redacted] in., minimum required thickness
- t actual = [redacted] in., Actual thickness
- P = [redacted] psig, Max. Internal Design gage Pressure
- P Rated = 4700 psig, internal design pressure
- T Rated = 400 F
- L = [redacted] in, Crown radius
- M = [redacted] a factor depending on the head proportion L/r
- D = [redacted] in, Inside diameter of head
- r = [redacted] in., inside knuckle radius
- S = 19300 psi, Maximum allowable working stress **ASME B31.3 Stainless Steel ASTM A479-316**
- E = 1 Joint Efficiency
- c = 0.02 in, Sum of mechanical allowances plus corrosion allowances and erosion allowances

The results of the calculations are as follows:

Description	D in.	L in.	r in.	L/r	M	t in.	tactual in.	P psig
Bowl Head	2.52	2.24	0.32	7.11	1.42	0.416	0.709	8022

The actual thickness exceeds the required therefore the thickness is acceptable.

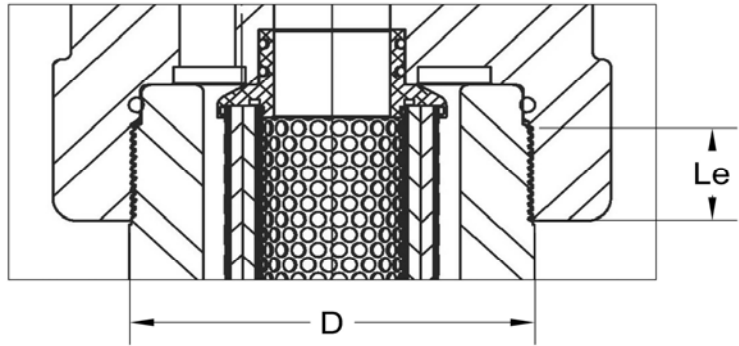
In accordance with ASME Section VIII-1 UG-32(i) since the inside radius is less than 3 times the head thickness ASME VIII-1 U-2(g) applies. See Report Section 1.

7/ Head to Bowl Connection - Thread Shear

The head to bowl connection is made using a straight threaded joint sealed by a O-Ring

In accordance with **ASME B31.3** para. 314.2.2

Threaded joints in which the tightness of the joint is provided by a seating surface other than the threads may be used.



In accordance with the ASME B31 codes and ASME Section II Part D Table 1A, Note (c) the allowable shear stress is 0.8X the basic allowable stress in tension.

The weakest material used for the threaded joint is: **ASME B31.3 Stainless Steel ASTM A479-316**
 This materials determined allowable stress at 400 F is 19,300 psi
 Therefore, the allowable shear stress is equal to: 19,300 x 0.8 = 15,440 psi

PROPERTIES

Thread Type: M100-2
 Pressure (P): 4700 psig, Internal Design Pressure
 Pressure Dia. (D): inch = Internal Thread Major Diameter
 Pressure Load (Ft): Lb. = P*(3.14*D^2/4)
 Pitch Diameter (Es): inch, Min External
 Pitch Diameter (En): inch, Max Internal
 Minor Diameter (Kn): inch, Max Internal
 Major Diameter (Ds): inch, Min External
 Thread/inch (n):
 Engagement Length (Le): inch

EXTERNAL THREAD ANALYSIS

The shear area of the external thread is given by the formula:

$As = 3.14*n*Le*Kn(1/2n+0.57735(Es-Kn))$

SIZE	D (in.)	Ft (Lbs.)	Es (in.)	Kn (in.)	n	Le (in.)	As (in^2)	Ss = Ft/As (psi)
M100-2	3.958	57828	3.877	3.867	4.23	1.073	6.84	8459

INTERNAL THREAD ANALYSIS

The shear area of the internal thread is given by the formula:

$An = 3.14*n*Le*Ds(1/2n+0.57735(Ds-En))$

SIZE	D (in.)	Ft (Lbs.)	Ds (in.)	En (in.)	n	Le (in.)	An (in^2)	Ss = Ft/An (psi)
M100-2	3.958	57828	3.924	3.8960	4.23	1.073	7.52	7692

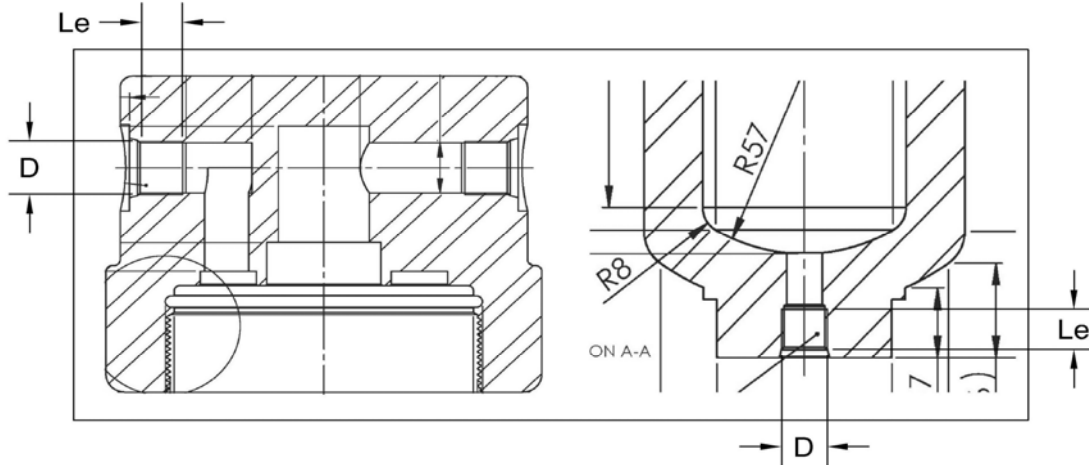
Since the shear stress in the thread (Ss) is less than thread joint allowable stress the threads are acceptable.

8/ SAE Process Connections - Thread Shear

The filter inlet, outlet and drain connections can be supplied with various SAE threaded connections.

In accordance with **ASME B31.3** para. 314.2.2

Threaded joints in which the tightness of the joint is provided by a seating surface other than the threads may be used.



The minimum thread length of the SAE process connections meet the requirements of SAE Standard J514 Table 4.

SAE

TABLE 4 - DIMENS

Nom Tube OD, in	J ₂ Full Thread Min mm	J ₂ Full Thread Min in	J ₃ Full Thread mm ±0.13	J ₃ Full Thread in ±0.005
1/8	6.38	0.251	5.94	0.234
3/16	7.16	0.282	5.94	0.234
1/4	7.62	0.300	6.73	0.265
5/16	8.41	0.331	6.73	0.265
3/8	8.46	0.333	7.92	0.312
1/2	9.52	0.375	8.74	0.344
5/8	11.71	0.461	9.93	0.391
3/4	11.91	0.469	11.91	0.469
7/8	13.11	0.516	11.91	0.469
1	14.30	0.563	11.91	0.469
1-1/4	14.30	0.563	11.91	0.469
1-1/2	16.79	0.661	11.91	0.469
2	21.44	0.844	11.91	0.469

In accordance with the ASME B31 codes and ASME Section II Part D Table 1A, Note (c) the allowable shear stress is 0.8X the basic allowable stress in tension.

The weakest material used for the threaded joint is:
 This materials determined allowable stress at
 Therefore, the allowable shear stress is equal to:

ASME B31.3 Stainless Steel ASTM A479-316
 400 F is 19,300 psi
 19,300 x 0.8 = 15,440 psi

PROPERTIES

Thread Type: SAE 04 - 0.250" Nom. Tube: 7/16-20 thread
 SAE 06 - 0.375" Nom. Tube: 9/16-18 thread
 SAE 08 - 0.500" Nom. Tube: 3/4-16 thread
 SAE 12 - 0.750" Nom. Tube: 1-1/16-12 thread
 SAE 16 - 1.000" Nom. Tube: 1-5/16-12 thread

Pressure (P): 4700 psig, Internal Design Pressure
 Pressure Dia. (D): inch = Internal Thread Major Diameter
 Pressure Load (Ft): Lb. = $P \cdot (3.14 \cdot D^2 / 4)$
 Pitch Diameter (Es): inch, Min External
 Pitch Diameter (En): inch, Max Internal
 Minor Diameter (Kn): inch, Max Internal
 Major Diameter (Ds): inch, Min External
 Thread/inch (n):
 Engagement Length (Le): inch

EXTERNAL THREAD ANALYSIS

The shear area of the external thread is given by the formula:

$$A_s = 3.14 \cdot n \cdot L_e \cdot K_n (1/2n + 0.57735(E_s - K_n))$$

SIZE	D (in.)	Ft (Lbs.)	Es (in.)	Kn (in.)	n	Le (in.)	As (in ²)	Ss = Ft/As (psi)
4	0.4375	707	0.3995	0.3950	20	0.260	0.18	3967
6	0.5625	1168	0.5205	0.5150	18	0.307	0.28	4220
8	0.7500	2076	0.7029	0.6960	16	0.339	0.42	4969
12	1.0625	4167	1.0010	0.9900	12	0.464	0.83	5011
16	1.315	6383	1.2509	1.2400	12	0.464	1.04	6136

INTERNAL THREAD ANALYSIS

The shear area of the internal thread is given by the formula:

$$A_n = 3.14 \cdot n \cdot L_e \cdot D_s (1/2n + 0.57735(D_s - E_n))$$

SIZE	D (in.)	Ft (Lbs.)	Ds (in.)	En (in.)	n	Le (in.)	An (in ²)	Ss = Ft/An (psi)
4	0.4375	707	0.4281	0.4104	20	0.260	0.25	2869
6	0.5625	1168	0.5524	0.5323	18	0.307	0.38	3093
8	0.7500	2076	0.7391	0.7159	16	0.339	0.56	3693
12	1.0625	4167	1.0494	1.0158	12	0.464	1.12	3718
16	1.315	6383	1.2994	1.2659	12	0.464	1.39	4603

Since the shear stress in the thread (Ss) is less than thread joint allowable stress the threads are acceptable.

9/ NPT Process Connections

Pipe connection threads are NPT and meet the requirements of ASME B1.20.1 which is accepted by ASME B31.3 per paragraph 314.2.

ASME B31.3 allow the use of NPT connections.

10/ Strength of Branch / Process Connections

In accordance with ASME B31.3 para. 304.3.2

304.3.2 Strength of Branch Connections. A pipe having a branch connection is weakened by the opening that must be made in it and, unless the wall thickness of the pipe is sufficiently in excess of that required to sustain the pressure, it is necessary to provide added reinforcement. The amount of reinforcement required to sustain the pressure shall be determined in accordance with para. 304.3.3 or 304.3.4. There are, however, certain branch connections that have adequate pressure strength or reinforcement as constructed. It may be assumed without calculation that a branch connection has adequate strength to sustain the internal and external pressure that will be applied to it if

(c) the branch connection utilizes an unlisted branch connection fitting (see para. 300.2), provided the fitting is made from materials listed in Table A-1 or Table A-1M and provided that the branch connection is qualified as required by para. 304.7.2.

In order to qualify the branch connections in accordance with ASME B31.3 para 304.7.2 a proof test was performed in accordance with ASME Section VIII-1 UG-101. See Report Section 1.0

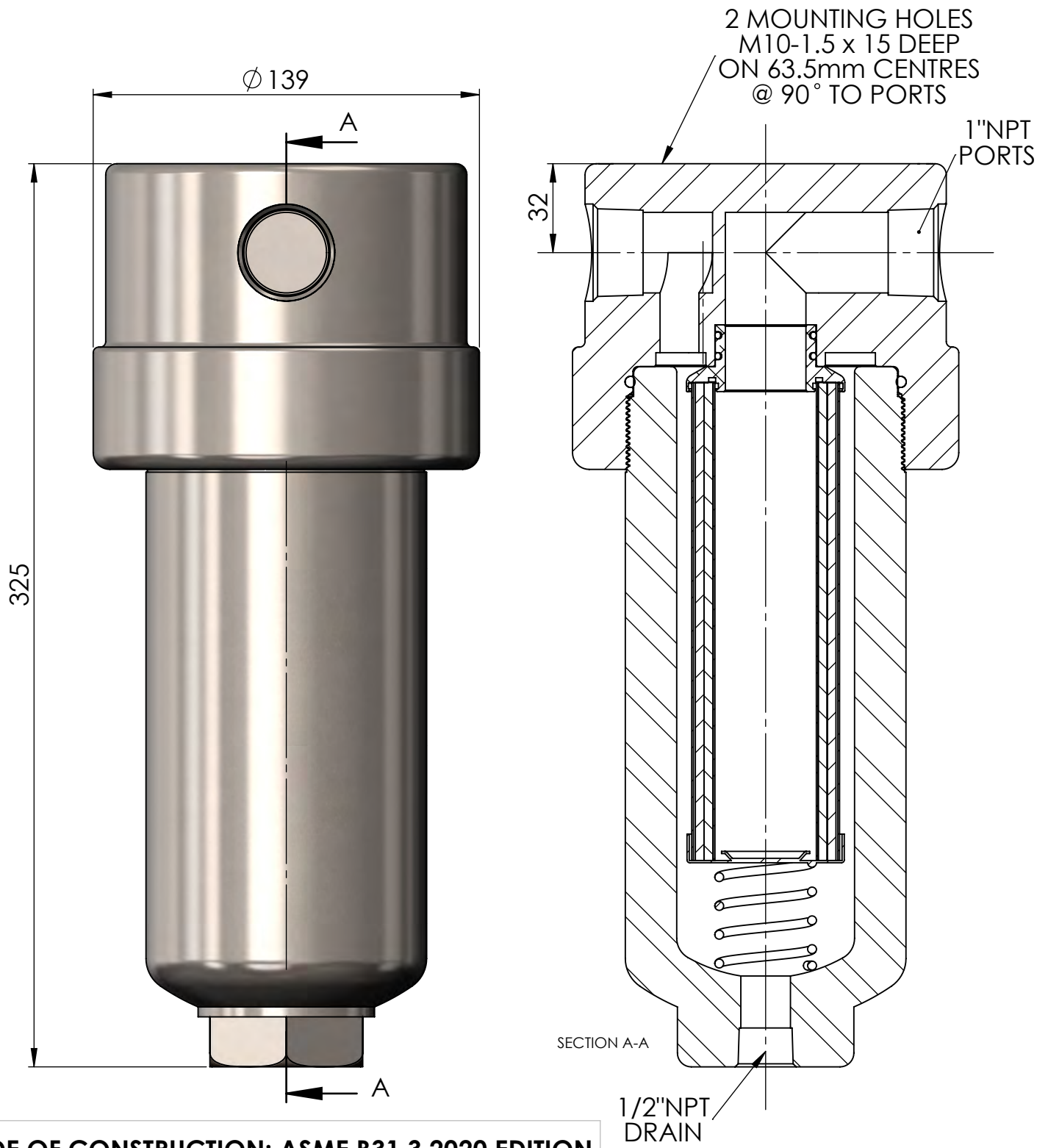
PREPARED BY:



**Scott Islip, P. Eng.
ROUND ENGINEERING INC.**

**15-Apr-22
Date**

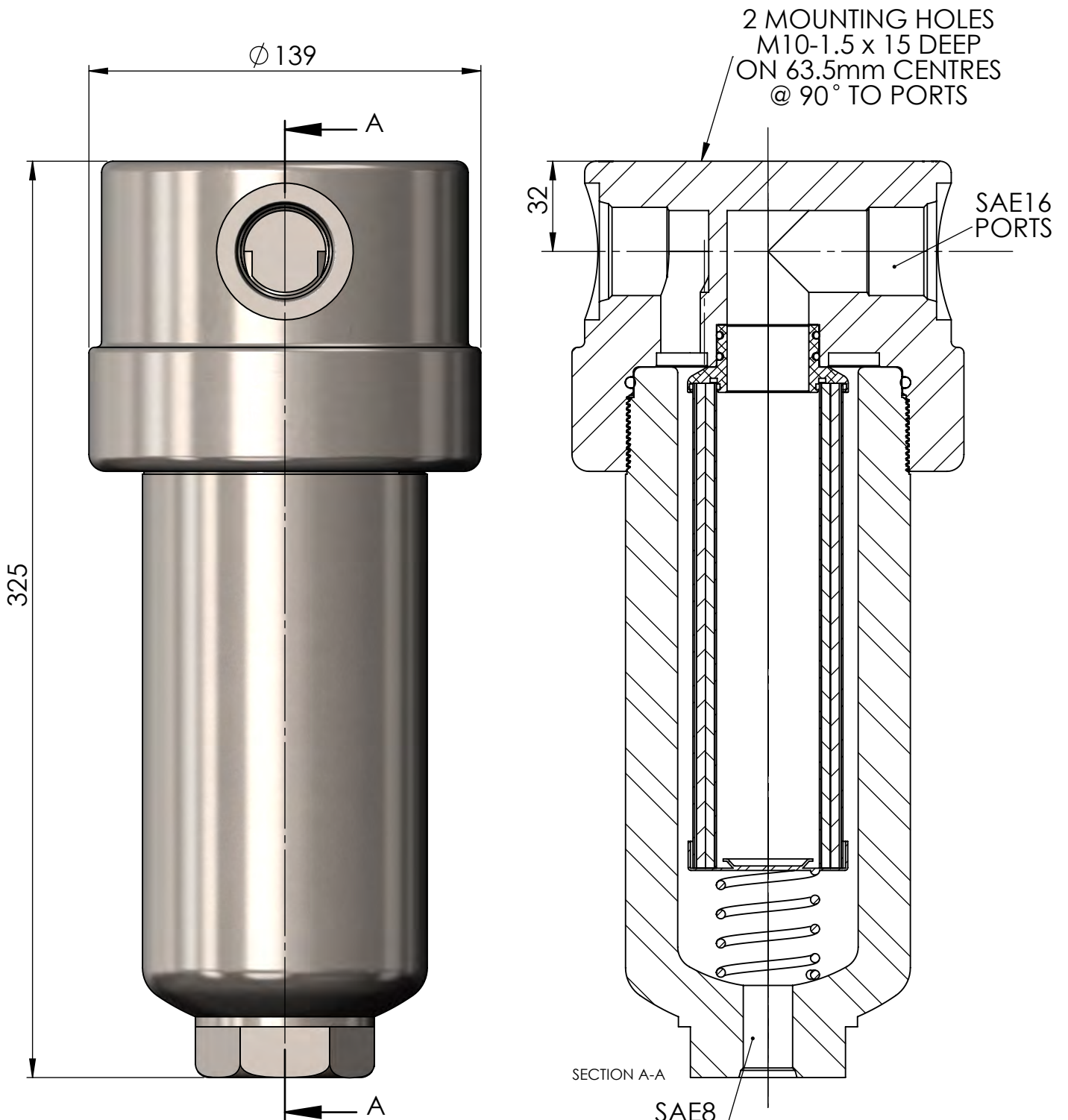
APPENDIX A



CODE OF CONSTRUCTION: ASME B31.3 2020 EDITION
MAWP: 5511 PSI (380 Bar)
MDMT: -320 °F @ 5511PSI (-196 ° @ 380 BAR)
HYDROTEST PRESSURE: 8267 PSI (570 BAR)
CORROSION ALLOWANCE: 0
IMPACT TEST EXEMPT PER 323.2.2
MAX TEMP: 400 °F (200C)
RT: NONE



217mm MIN CLEARANCE FOR BOWL REMOVAL

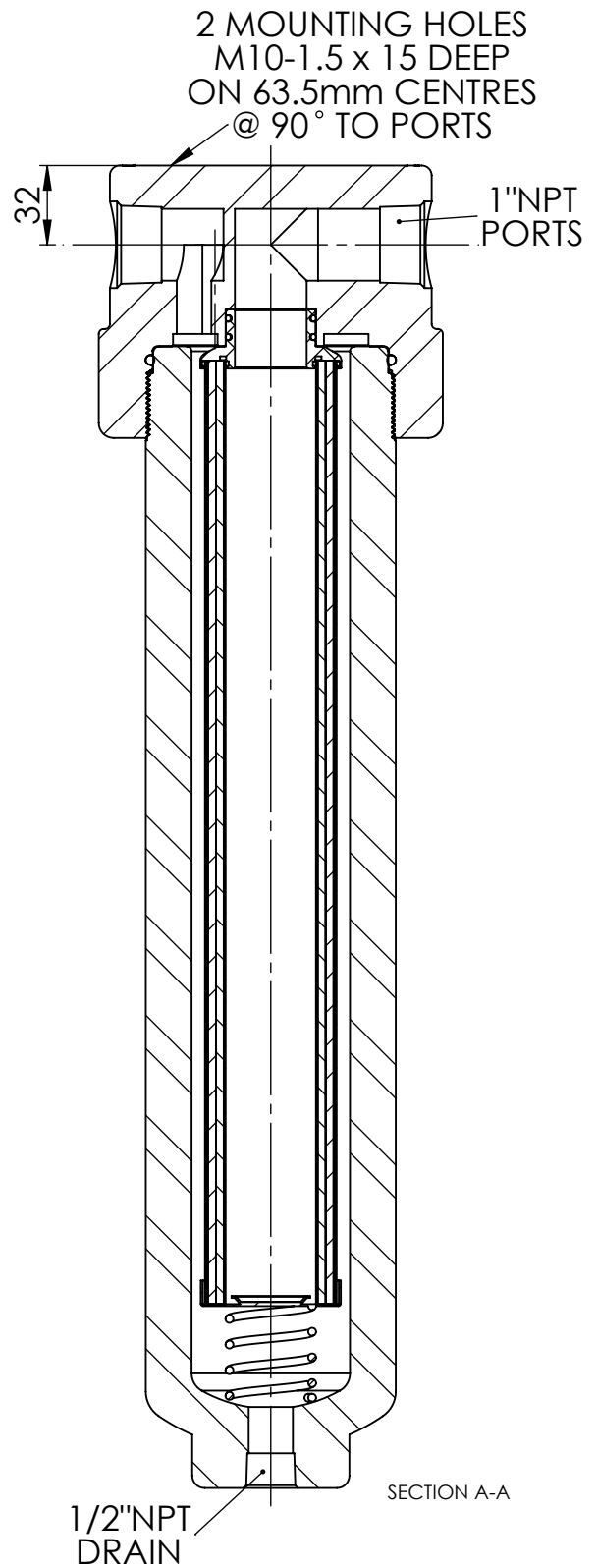
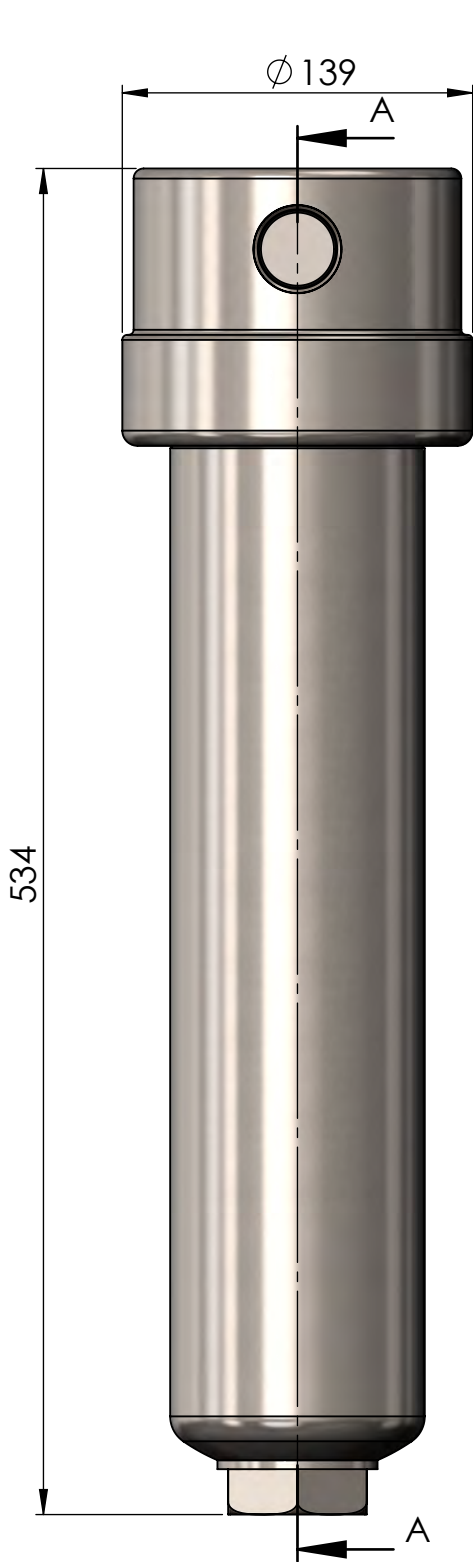
IF IN DOUBT ASK	PART DESCRIPTION:			SCALE: 1:2
Headline Filters Ltd Unit 1-2 Mill Hall Business Estate Aylesford Kent ME20 7JZ Tel: 01622 718927 Fax: 01622 882448 www.headlinefilters.com	180VP-4524 1"NPT~1/2"NPT GA			ECN No: * DRAWN BY: J.Rose DATE: 10/01/2022
DO NOT SCALE	DESIGN PRESSURE: 380 bar GENERAL TOLERANCE: X. +/- 0.25 X.XX +/- 0.125	DESIGN TEMPERATURE: 200 Deg C MATERIAL: SA4779 316/L	SURFACE FINISH: 32/ DRAWING NUMBER: HF4/4642	THE COPYRIGHT OF THIS DRAWING IS RESERVED BY HEADLINE FILTERS LTD. IT IS ISSUED ON CONDITION IT IS NOT COPIED, REPRODUCED OR ISSUED TO ANY THIRD PARTY, EITHER WHOLLY OR IN PART WITHOUT CONSENT IN WRITING FROM HEADLINE FILTERS LTD.



CODE OF CONSTRUCTION: ASME B31.3 2020 EDITION
MAWP: 5511 PSI (380 Bar)
MDMT: -320 °F @ 5511PSI (-196 ° @ 380 BAR)
HYDROTEST PRESSURE: 8267 PSI (570 BAR)
CORROSION ALLOWANCE: 0
IMPACT TEST EXEMPT PER 323.2.2
MAX TEMP: 400 °F (200C)
RT: NONE

217mm MIN CLEARANCE
FOR BOWL REMOVAL

IF IN DOUBT ASK	PART DESCRIPTION: 180VP-4524 SAE16~SAE8 GA			SCALE: 1:2	
Headline Filters Ltd Unit 1-2 Mill Hall Business Estate Aylesford Kent ME20 7JZ Tel: 01622 718927 Fax: 01622 882448 www.headlinefilters.com 	DESIGN PRESSURE: 380 bar	DESIGN TEMPERATURE: 200 Deg C	SURFACE FINISH: 	ECN No: * DRAWN BY: J.Rose	THE COPYRIGHT OF THIS DRAWING IS RESERVED BY HEADLINE FILTERS LTD. IT IS ISSUED ON CONDITION IT IS NOT COPIED, REPRODUCED OR ISSUED TO ANY THIRD PARTY, EITHER WHOLLY OR IN PART WITHOUT CONSENT IN WRITING FROM HEADLINE FILTERS LTD.
DO NOT SCALE	GENERAL TOLERANCE: X. +/- 0.25 X.XX +/- 0.125	MATERIAL: SA477 316/L	DRAWING NUMBER: HF4/4650	DATE: 10/01/2022	



CODE OF CONSTRUCTION: ASME B31.3 2020 EDITION
MAWP: 5511 PSI (380 Bar)
MDMT: -320 °F @ 5511PSI (-196 ° @ 380 BAR)
HYDROTEST PRESSURE: 8267 PSI (570 BAR)
CORROSION ALLOWANCE: 0
IMPACT TEST EXEMPT PER 323.2.2
MAX TEMP: 400 °F (200C)
RT: NONE

IF IN DOUBT ASK

Headline Filters Ltd
 Unit 1-2 Mill Hall Business Estate
 Aylesford
 Kent
 ME20 7JZ
 Tel: 01622 718927
 Fax: 01622 882448
 www.headlinefilters.com



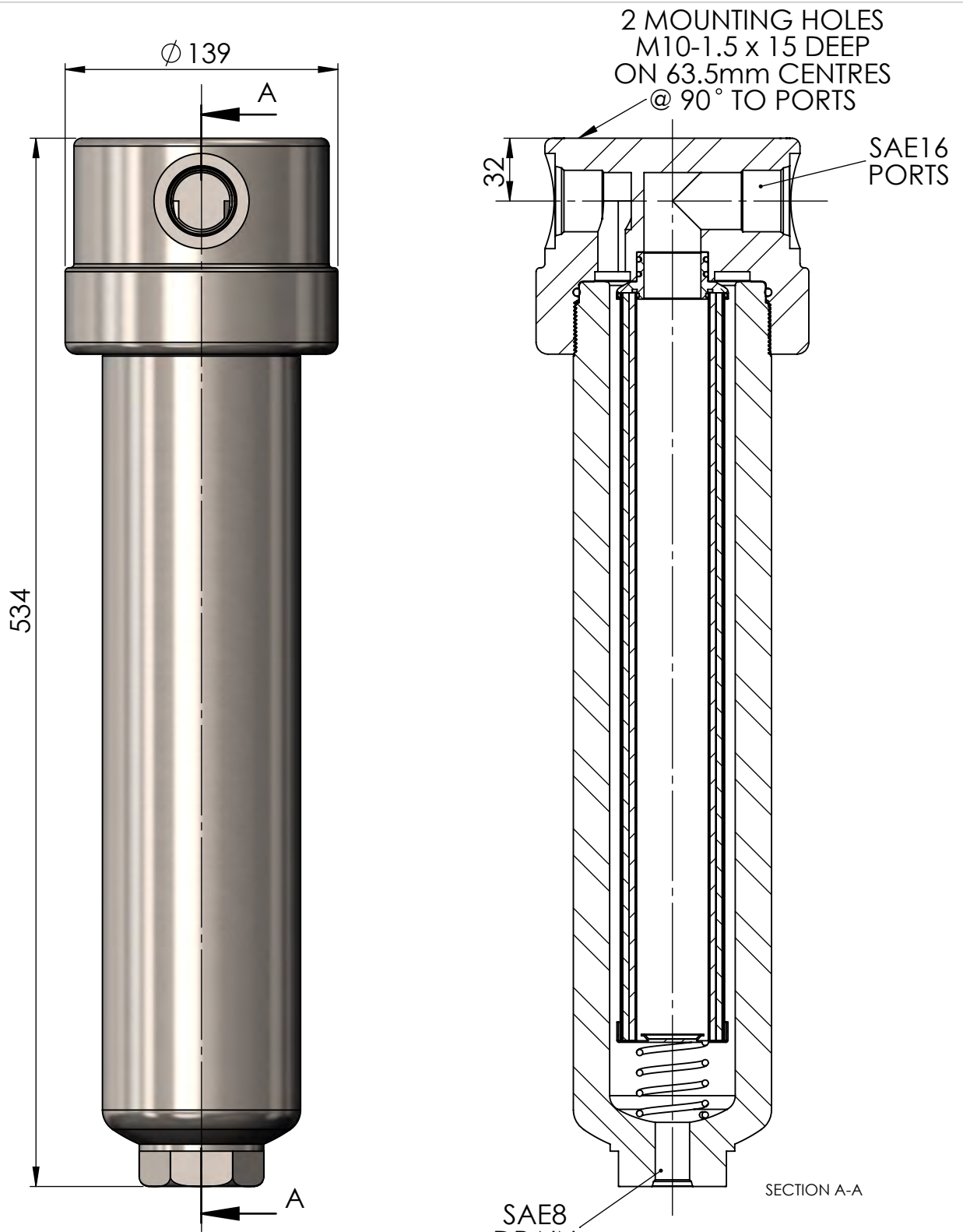
DO NOT SCALE



PART DESCRIPTION:		
180VP-4607GA 1"NPT~1/2"NPT		
DESIGN PRESSURE:	DESIGN TEMPERATURE:	SURFACE FINISH:
380 Bar	200 ° C	$\frac{32}{\nabla}$
GENERAL TOLERANCE:	MATERIAL:	DRAWING NUMBER:
X. +/- 0.25 X.XX +/- 0.125	SA479 318/L	HF4/4607

SCALE:	1:3
ECN No:	*
DRAWN BY:	J.Rose
DATE:	10/01/2022

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CODE OF CONSTRUCTION: ASME B31.3 2020 EDITION
MAWP: 5511 PSI (380 Bar)
MDMT: -320 °F @ 5511PSI (-196 ° @ 380 BAR)
HYDROTEST PRESSURE: 8267 PSI (570 BAR)
CORROSION ALLOWANCE: 0
IMPACT TEST EXEMPT PER 323.2.2
MAX TEMP: 400 °F (200C)
RT: NONE

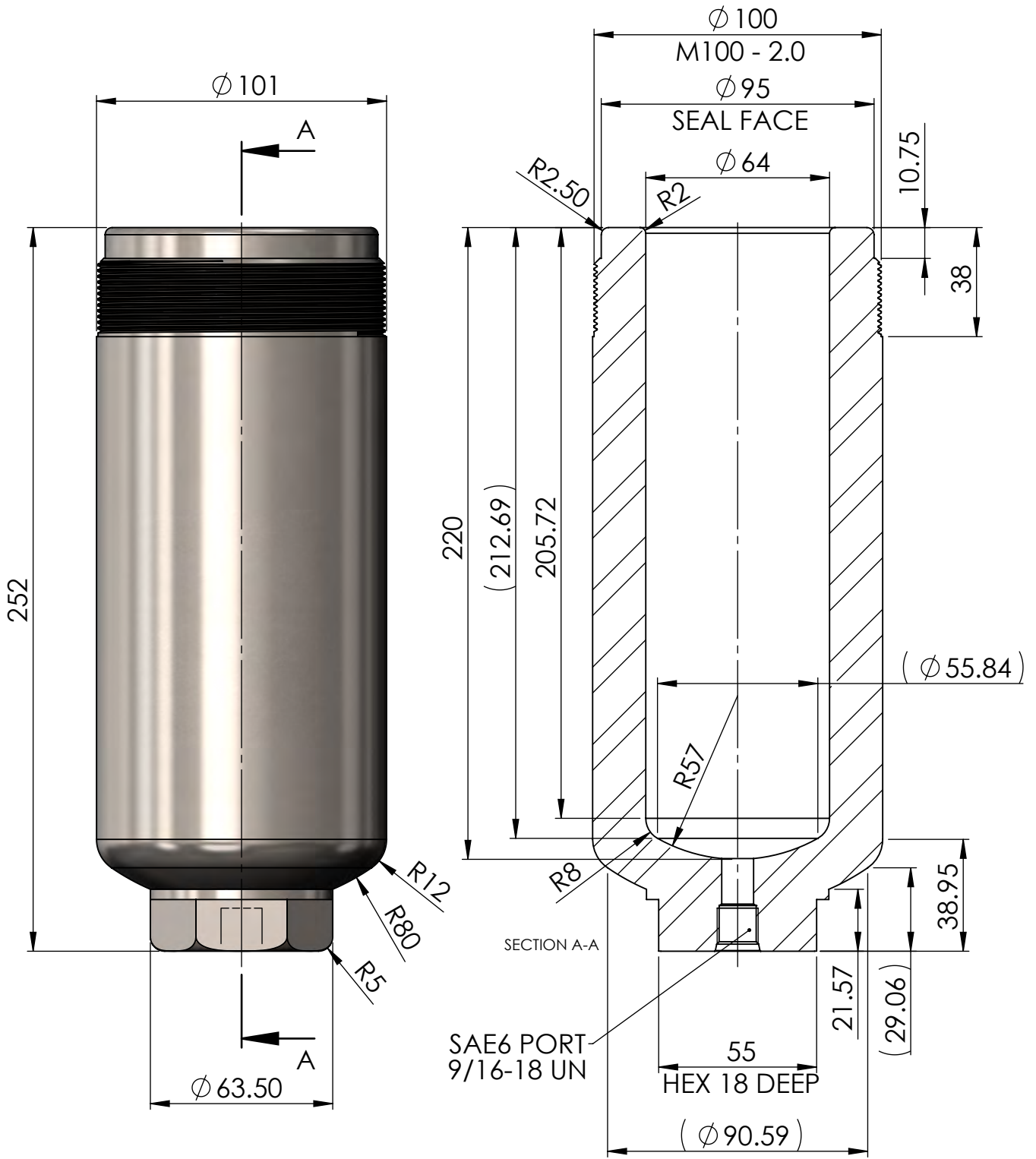
425mm MIN CLEARANCE FOR BOWL REMOVAL

IF IN DOUBT ASK Headline Filters Ltd Unit 1-2 Mill Hall Business Estate Aylesford Kent ME20 7JZ Tel: 01622 718927 Fax: 01622 882448 www.headlinefilters.com	PART DESCRIPTION: <p style="text-align: center;">180VP-4607GA SAE16~SAE8</p>			SCALE: 1:3
	DESIGN PRESSURE: 380 Bar	DESIGN TEMPERATURE: 200 ° C	SURFACE FINISH: $\sqrt{32}$	ECN No: *
GENERAL TOLERANCE: X. +/- 0.25 X.XX +/- 0.125	MATERIAL: SA479 318/L	DRAWING NUMBER: HF4/4616	DRAWN BY: J.Rose	
DO NOT SCALE	Page 20 of 40	DATE: 10/01/2022		




JOB No:

MATERIAL No:



SHARP EDGES AND BURRS TO BE REMOVED

<p>IF IN DOUBT ASK</p>	<p>DRAWING ISSUED BY:</p>	<p>ISSUE DATE:</p>	<p>QUANTITY:</p>	<p>SCALE: 1:2</p>
<p>Headline Filters Ltd Unit 1-2 Mill Hall Business Estate Aylesford Kent ME20 7JZ Tel: 01622 718927 Fax: 01622 882448 www.headlinefilters.com</p> 	<p>PART DESCRIPTION: 180VP SAE6 BOWL</p>		<p>ECN No: *</p>	<p>THE COPYRIGHT OF THIS DRAWING IS RESERVED BY HEADLINE FILTERS LTD. IT IS ISSUED ON CONDITION IT IS NOT COPIED, REPRODUCED OR ISSUED TO ANY THIRD PARTY, EITHER WHOLLY OR IN PART WITHOUT CONSENT IN WRITING FROM HEADLINE FILTERS LTD.</p>
<p>GENERAL TOLERANCE:</p>	<p>MATERIAL: SA4793 PL</p>	<p>SURFACE FINISH: $\sqrt{32}$</p>	<p>DRAWN BY: J.Rose</p>	
<p>X. +/- 0.25 X.XX +/- 0.125</p>	<p>DRAWING NUMBER: HF4/4257</p>	<p>DATE: 10/02/2022</p>		

DO NOT SCALE

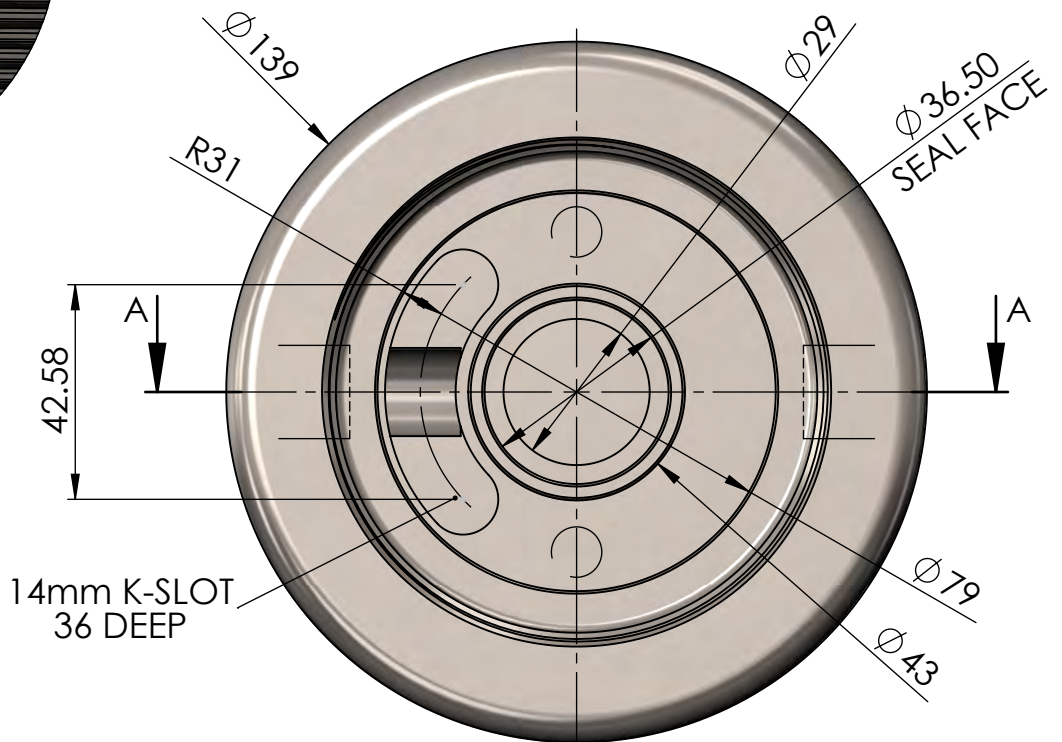
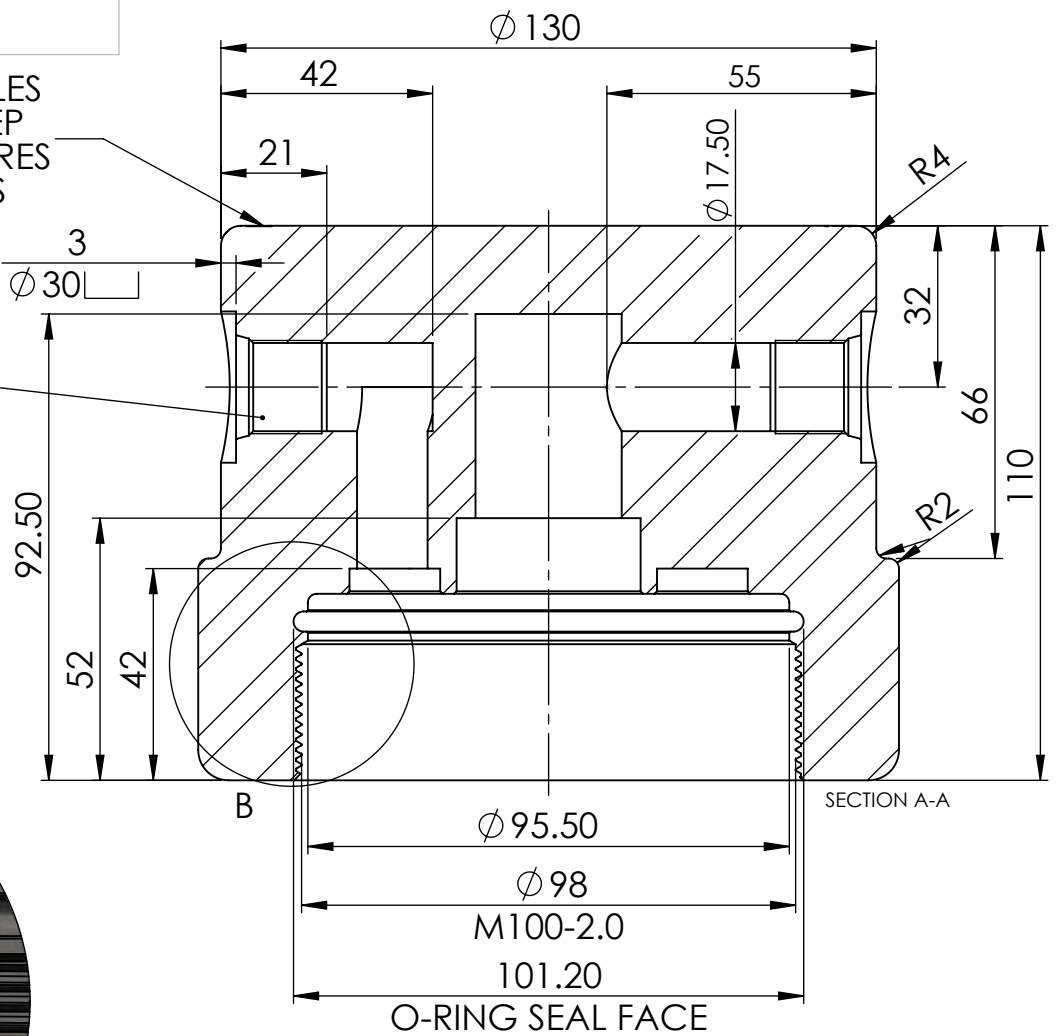
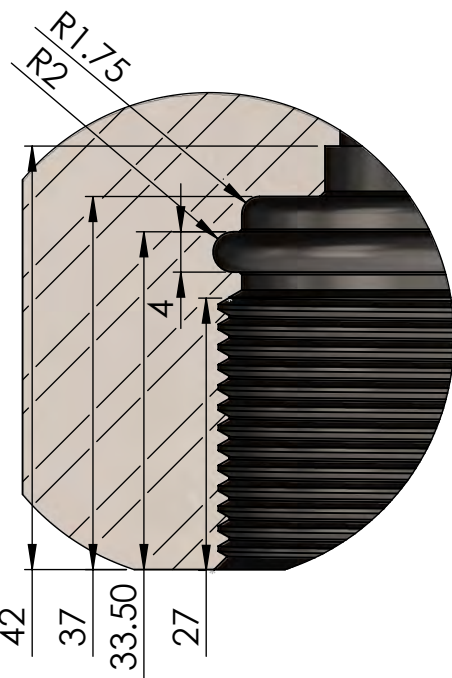


JOB No:

MATERIAL No:

2 MOUNTING HOLES
M10-1.5 x 15 DEEP
ON 63.5mm CENTRES
@ 90° TO PORTS

SAE8 PORTS
3/4-16 UN



BS240
BS124

IF IN DOUBT ASK

DRAWING ISSUED BY:

ISSUE DATE:

QUANTITY:

SCALE:

1:1.5

Headline Filters Ltd

Unit 1-2 Mill Hall Business Estate
Aylesford
Kent
ME20 7JZ
Tel: 01622 718927
Fax: 01622 882448
www.headlinefilters.com



PART DESCRIPTION:

180VP HEAD SAE8

ECN No:

*

SURFACE FINISH:

32/
▽

DRAWN BY:

J.Rose

GENERAL TOLERANCE:

X. +/- 0.25
X.XX +/- 0.125

MATERIAL:

SA477316L

DRAWING NUMBER:

HF4/4522

DATE:

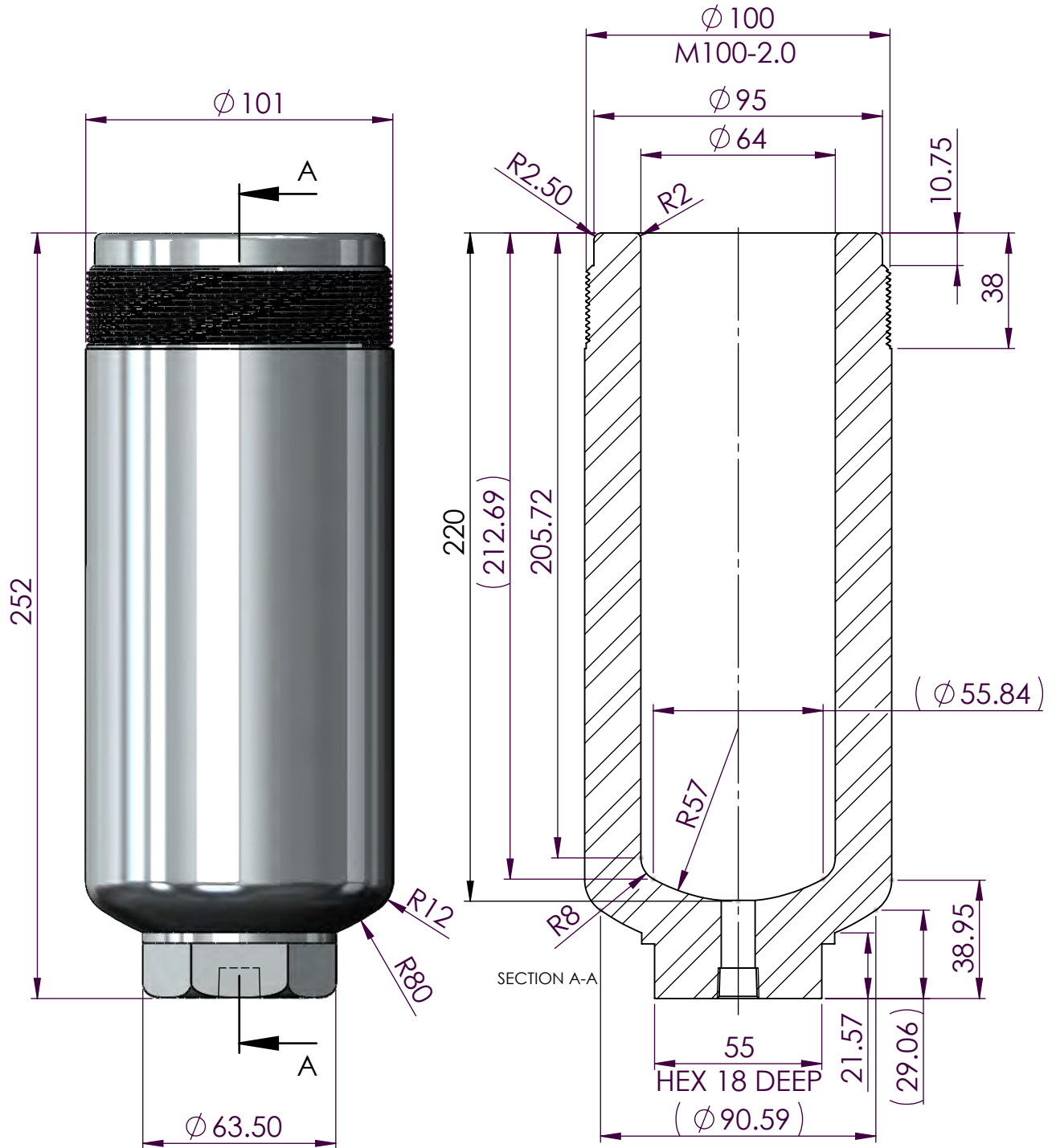
10/01/2022

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DO NOT SCALE

JOB No:

MATERIAL No:



IF IN DOUBT ASK

DRAWING ISSUED BY:

ISSUE DATE:

QUANTITY:

SCALE:

1:2

Headline Filters Ltd

Unit 1-2 Mill Hall Business Estate
Aylesford
Kent
ME20 7JZ
Tel: 01622 718927
Fax: 01622 882448
www.headlinefilters.com



PART DESCRIPTION:

180VP BOWL 1/4"NPT

ECN No:

*

SURFACE FINISH:

32/
▽

DRAWN BY:

J.Rose

GENERAL TOLERANCE:

X. +/- 0.25
X.XX +/- 0.125

MATERIAL:

SA477316L

DRAWING NUMBER:

HF4/4256

DATE:

04/11/2016

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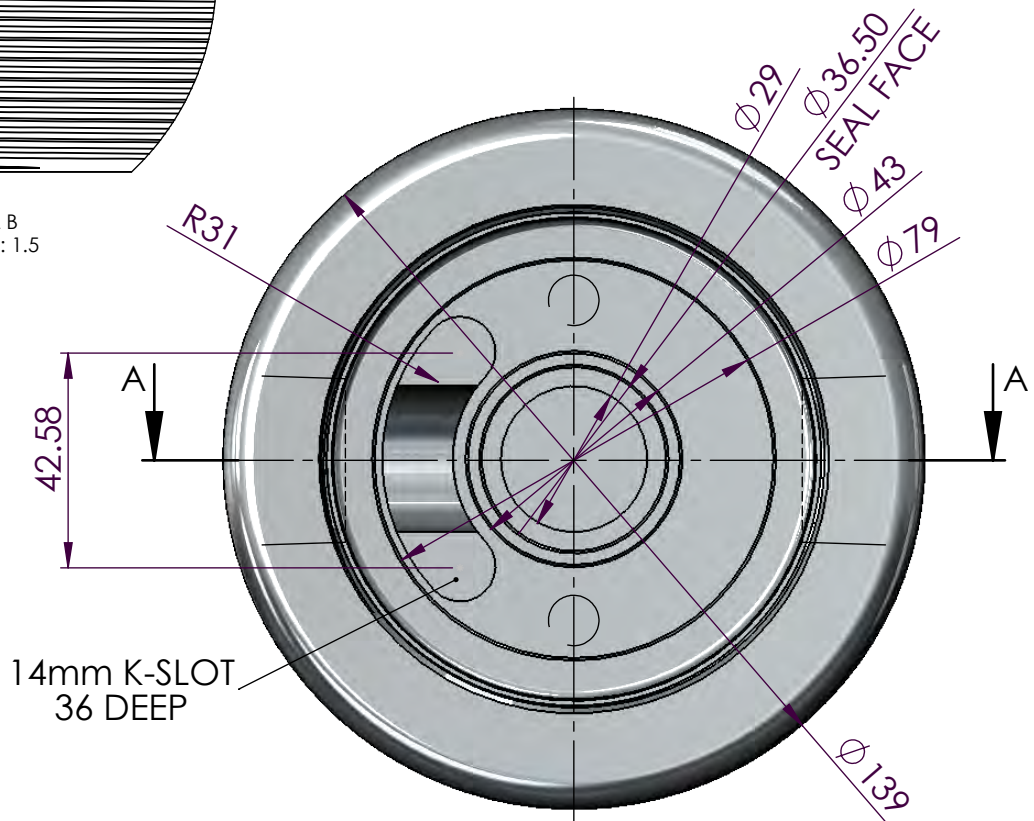
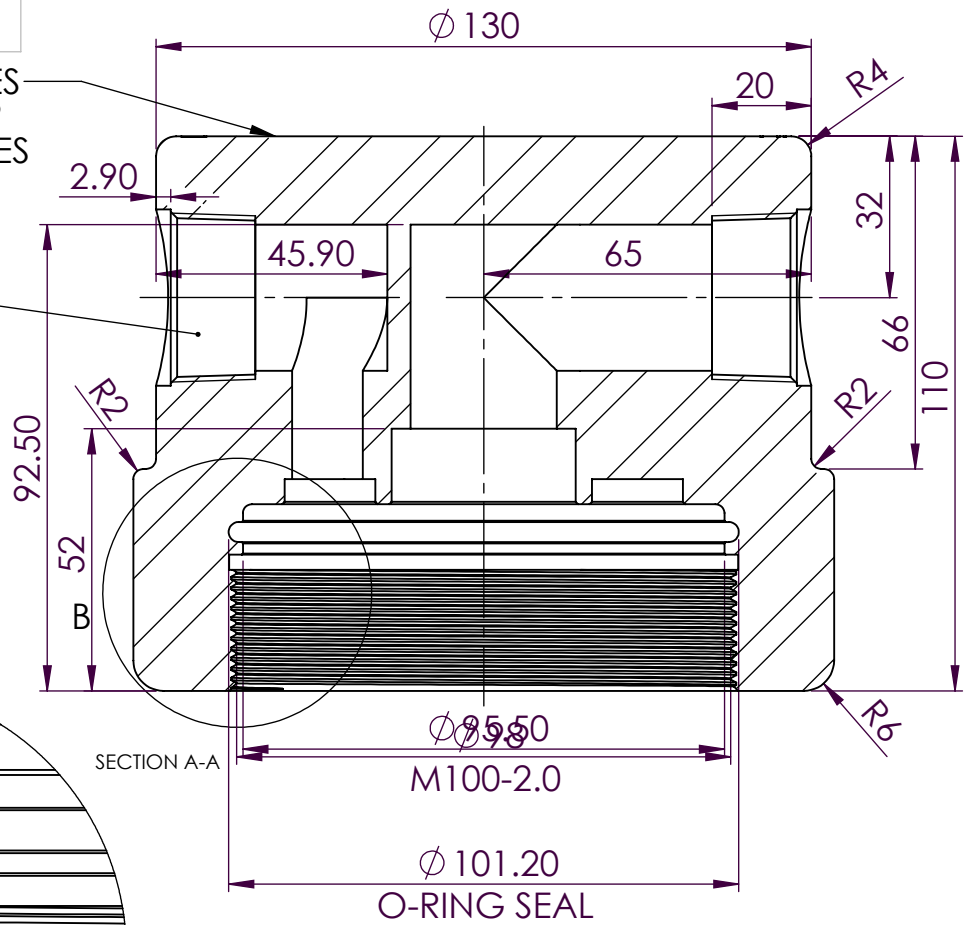
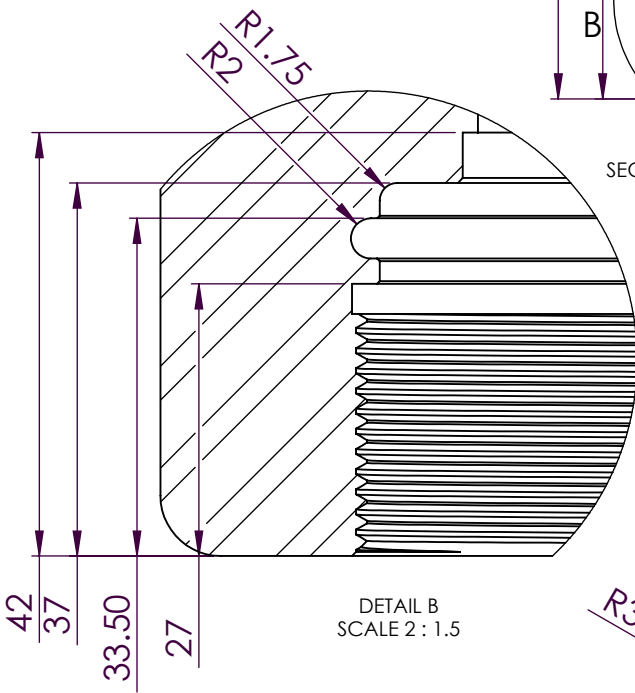
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JOB No:

MATERIAL No:

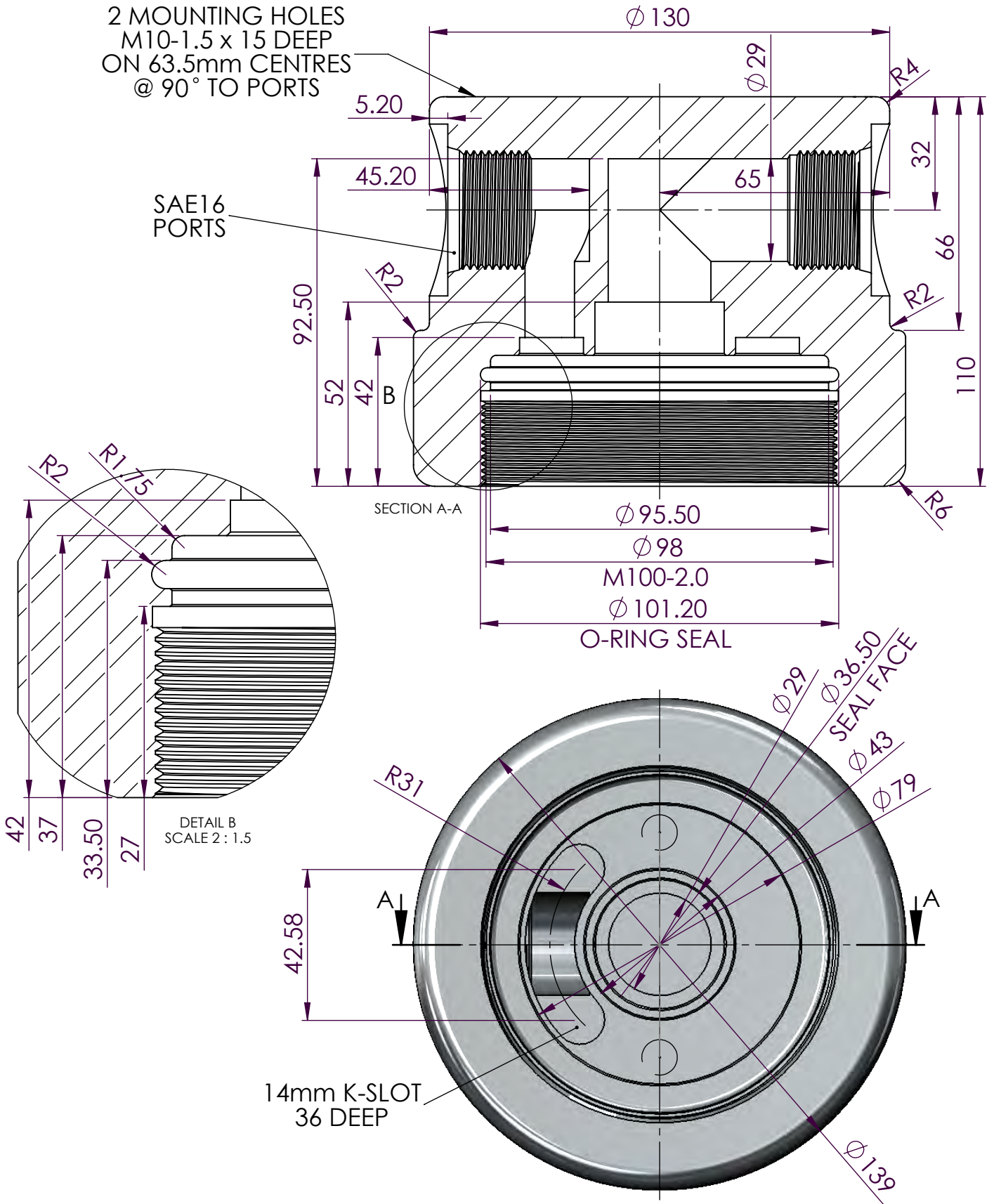
2 MOUNTING HOLES
M10-1.5 x 15 DEEP
ON 63.5mm CENTRES
@ 90° TO PORTS


1" NPT
PORTS



<p>IF IN DOUBT ASK</p> <p>Headline Filters Ltd Unit 1-2 Mill Hall Business Estate Aylesford Kent ME20 7JZ Tel: 01622 718927 Fax: 01622 882448 www.headlinefilters.com</p>  <p>DO NOT SCALE</p>	<p>DRAWING ISSUED BY:</p>	<p>ISSUE DATE:</p>	<p>QUANTITY:</p>	<p>SCALE: 1:1.5</p>
	<p>PART DESCRIPTION: 180VP HEAD 1" NPT</p>		<p>ECN No: *</p>	<p>THE COPYRIGHT OF THIS DRAWING IS RESERVED BY HEADLINE FILTERS LTD. IT IS ISSUED ON CONDITION IT IS NOT COPIED, REPRODUCED OR ISSUED TO ANY THIRD PARTY, EITHER WHOLLY OR IN PART WITHOUT CONSENT IN WRITING FROM HEADLINE FILTERS LTD.</p>
<p>GENERAL TOLERANCE: X. +/- 0.25 X.XX +/- 0.125</p>	<p>MATERIAL: SA477316L</p>	<p>SURFACE FINISH: 32/ ▽</p>	<p>DRAWN BY: J.Rose</p>	<p>DATE: 25/10/2016</p>
<p>DRAWING NUMBER: HF4/4251</p>		<p>Page 24 of 40</p>		

2 MOUNTING HOLES
M10-1.5 x 15 DEEP
ON 63.5mm CENTRES
@ 90° TO PORTS



<p>IF IN DOUBT ASK</p> <p>Headline Filters Ltd Unit 1-2 Mill Hall Business Estate Aylesford Kent ME20 7JZ Tel: 01622 718927 Fax: 01622 882448 www.headlinefilters.com</p>  <p>DO NOT SCALE</p>	<p>DRAWING ISSUED BY:</p>	<p>ISSUE DATE:</p>	<p>QUANTITY:</p>	<p>SCALE: 1:1.5</p>
	<p>PART DESCRIPTION: 180VP HEAD SAE16</p>		<p>ECN No: *</p>	<p>THE COPYRIGHT OF THIS DRAWING IS RESERVED BY HEADLINE FILTERS LTD. IT IS ISSUED ON CONDITION IT IS NOT COPIED, REPRODUCED OR ISSUED TO ANY THIRD PARTY, EITHER WHOLLY OR IN PART WITHOUT CONSENT IN WRITING FROM HEADLINE FILTERS LTD.</p>
<p>GENERAL TOLERANCE: X. +/- 0.25 X.XX +/- 0.125</p>	<p>MATERIAL: SA477316L</p>	<p>SURFACE FINISH: 32/ ▽</p>	<p>DRAWN BY: J.Rose</p>	<p>DATE: 25/10/2016</p>
<p>DRAWING NUMBER: HF4/4252</p>		<p>Page 25 of 40</p>		

APPENDIX B



COGNE ACCIAI SPECIALI S.p.a.

ITALY - 11100 AOSTA - VIA PARAVERA, 16
TEL +39.0165.3021 - FAX +39.0165.30296
CAP. SOC. 200.000.000 EUR INT. VERS.
C.F. 0218736967
VAT: IT00571320076 - R.E.A. n. AO-50474

Company with Management Systems
certified according to ISO 9001, IATF 16949,
EN 9100 and ISO 14001.

INSPECTION CERTIFICATE 3.1 (EN 10204:2004)
DOCUMENT NUMBER 2021058144
PAGE 1/3

CUSTOMER:
CUSTOMER'S ORDER:
MANUFACTURER'S WORKS:
PRODUCER OF THE DOC:
MANUFACTURER'S WORKS ORDER NO:
MARK OF THE MANUFACTURER:

COGNE U.K. LIMITED
P1-40352
AOSTA, VIA PARAVERA 16 - ITALY
QUALITY DEPARTMENT
25285011 /30
COGNE

DISPATCH NOTE:

THE CERTIFIED PRODUCTS ARE COMPLYING TO THE PURCHASE ORDER, EXCEPT FOR EXEMPTIONS AGREED WITH THE CUSTOMER, IF ANY.
INTERNAL SPEC:
PRODUCT:
SURFACE FINISH:
PRODUCT DELIVERY CONDITION:
PRODUCT DIMENSIONS (mm):
GRADE:
IDENTIFICATION HEAT NO:
MARKING OF THE PRODUCT:

WEIGHT:
AD2000MERKBLATTW10
SPE ROUGHPEELED ROUND BARS TOLERANCE: + 1,500 - 0,0000 (+ 0,0591 - 0 in)
1X Hot Finished

RS SOLUTION ANNEALED
139,700 (5,500 in)
316L-S31600/31603-1.4404/1.4401 LENGTH (mm) 04000 06000 (00157 00236 in)
173482 INTERNAL GRADE: F316L IMCO
1.4404 IDENTIFICATION LOT NO: 903460
TEST PIECE N: 346

AISI 316/316L - UNS S31600/S31603 - 1.4404/1.4401
DOCUMENT ISSUED IN AGREEMENT WITH TUEV BAYERN(11.1972) WAVING OF COUNTERSIGNING (SEE TUEV BAYERN LETTER DATED 17.01.80).
REFERENCE NORMS:EN 10088-3, EN 10272, ASTM A276/ASME SA276, ASTM A479/ASME SA479, ASTM A193 B8M CLASSE 1D,
ISO15156-3/NACE MR0175, NACE MR0103/ISO 17945.

REFERENCE NORMS FOR CHEMICAL COMPOSITION AND MECHANICAL PROPERTIES: ASTM A182/ASME SA182
REFERENCE NORMS FOR CHEMICAL COMPOSITION ONLY: EN 10222-5, ASTM A484, ASTM A403, ASTM A314.
REFERENCE NORMS: EN 10088-3 2014, EN 10272 2016, ASTM A276/A276M, ASTM A479/A479M, ASTM A193 B8MCLASSE 1D, ASME SA276/SA276M, ASME SA479/SA479M, AMS 5648M, ISO15156-3/NACE MR0175 2015, NACE MR0103/ISO 17945, NORSOK M630 MDSS01 REV5.
REFERENCE NORMS FOR CHEMICAL COMPOSITION AND MECHANICAL PROPERTIES: ASTM A182, ASME SA182.
REFERENCE NORMS ONLY FOR CHEMICAL COMPOSITION: EN 10222-5 2017, ASTM A403-07a, ASTM A484-18a, ASTM A314-08, AMS-QQ-S-763D.
ASME SECT.II PART A EDITION 2015-2017-2019
STEELMAKING EAF + AOD + CONTINUOUS CASTING

THE MATERIAL IS PRODUCED ACCORDING TO SPECIFICATION AD2000-MERKBLATT W2/W10
HOT ROLLED
REDUCTION RATIO 5,5

CHEMICAL LADLE ANALYSIS ACCORDING TO ASTM A751 - EN ISO 14284
Control lot No. - Weight :020000885679 - 87.373 KG - 192.621 LB
ELEMENTS C Si Mn P S Ni Cr Mo Cu
OBTAINED 0,015 0,23 1,78 0,026 0,025 0,079 16,89 2,06 0,39
ELEMENTS Co
OBTAINED 0,14

HEAD

HARDNESS TEST IN AS DELIVERY CONDITION
Control lot No. - Weight :020000897121 - 3.073 KG - 6.775 LB
SPECIFICATION ENISO6506 HARDNESS TEST HB TESTING METHOD: 10/3000
OBTAINED 140

COGNE GROUP
CHECKED BY fm
- 0 JAN 2022
PAGE NO. Q166565

DATE 10.12.2021

BARBARA VIETTI MV(WORKS INSPECTOR) - ELECTRONICALLY GENERATED CERTIFICATE

-Cogne



COGNE ACCIAI SPECIALI S.p.a.

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C.F. 02187360967
VAT: IT00571320076 - R.E.A. n. AO-50474

Company with Management Systems certified
according to ISO 9001, IATF 16949, EN 9100 and
ISO 14001.

INSPECTION CERTIFICATE 3.1 (EN 10204:2004)
DOCUMENT NUMBER 2021058144
PAGE 2/3

IMPACT TEST IN AS DELIVERY CONDITION

Control lot No. - Weight :020000897121 - EN ISO 148-1-KV2 3.073 KG - 6.775 LB
SPECIFICATION
TYPE OF TEST PIECE DIRECTION OF THE TEST PIECE: L
TEST TEMPERATURE °C 20
MEASUREMENT UNIT J 432 434 435 430 430 433 437
OBTAINED 434 436 432 434 435 430 430 437

TENSILE TEST IN AS DELIVERY CONDITION

Control lot No. - Weight :020000897121 - EN-ISO6892-1 3.073 KG - 6.775 LB
SPECIFICATION
MEASUREMENT UNIT RM RPO2 A5 Z RPI
MPA MPA % MPA
OBTAINED 547 233 5.0 D 79,5 272
559 239 66,1 79,2 273
551 230 62,7 79,3 270
572 252 60,2 71,5 286

Page

GRAIN SIZE

Control lot No. - Weight :020000897121 - ASTM E112 -- 3.073 KG - 6.775 LB
SPECIFICATION
OBTAINED 5 7

CORROSION TEST ACCORDING TO ASTM A262 PRACTICE E EN ISO 3651-2 PRACTICE A: SATISFACTORY.

MATERIAL ACCORDING TO ASME SEC. II Ed. 2015
IMPACT TEST
Control lot No. - Weight :020000897121 - EN ISO 148-1 3.073 KG - 6.775 LB
SPECIFICATION EN ISO 148-1
TYPE OF TEST PIECE KV 196-
TEST TEMPERATURE °C J 215 211 217 213 207 213 213
MEASUREMENT UNIT J 209 199 215 213 207 213 213
OBTAINED 219 215

COGNE GROUP
CHIEF OFFICER
- 6 JAN 2021
WGT No. 0166566



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INSPECTION CERTIFICATE 3.1 (EN 10204:2004)
DOCUMENT NUMBER 2021058144
PAGE 3/3

TENSILE TEST

Control lot No. - Weight : 020000897121 -
SPECIFICATION : ASTM A370-E8-0.5" SPEC

3.073 KG -
ASTMA370-E8-0.5" SPEC

6.775 LB

DIRECTION OF THE TEST PIECE: L

MEASUREMENT UNIT

OBTAINED

TS KSI	YS KSI	RA %	EL %
81	35	76,0	4,0 D
83	36	71,7	61,7
80	34	76,8	58,1
83	37	75,1	66,1
			61,5

MATERIAL ACCORDING TO NACE MR0103/ISO 17945

ULTRASONIC TEST ACCORDING TO EN 10308 Class.3, EN 10228 Class.3, ASTM A388 FBH 5 (diam. 102-250), FBH 8 (diam. 250,01-400).
VISUAL INSPECTION OF SURFACE AND DIMENSIONAL CONTROL ACCORDING TO EN10221 CLASS C AND EN10060: SATISFACTORY.
ANTIMIX TEST BY PORTABLE SPECTROMETER: SATISFACTORY.

NO WELDING REPAIR ON THE MATERIAL.

FREE FROM RADIOACTIVITY CONTAMINATION.

MARKING: SYMBOL OF THE MANUF. WORK, MATERIAL N., LOT N., RECEIVING AGENT STAMP
COUNTRY OF MELTING AND ORIGIN: ITALY, THE MATERIAL COMPLIES WITH FAR DFARS

252-225-7009 ALT 1.

THE PRODUCT SATISFIES THE DIRECTIVES: 2015/863/EU (ROHS3) - 2011/65/EU (ROHS2) - 2000/53/EU - 2002/95/EU (RoHS) - 2003/11/EU -

2002/618/EU AND PED 2014/68/EU.

ALL THE NORMS MENTIONED ARE INTENDED IN THEIR LAST REVISION AT THE DATE OF ISSUE OF THIS DOCUMENT.

QUALITY SYSTEM CERTIFIED BY KIWA CERMET ACCORDING TO UNI EN ISO 9001:2015 - IATF 16949:2016 (THE LAST ONE ONLY FOR WIRE ROD AND HOT

ROLLED-PEELED-GROUND STAINLESS STEEL BARS).

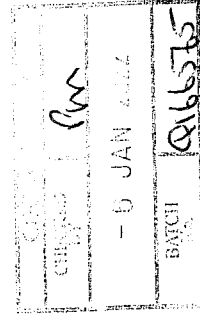
INSPECTOR'S STAMP IF

THE MATERIAL IS FREE OF ANY MERCURY, MERCURY COMPOUNDS AND OR RADIUM CONTAMINATION AT TIME OF SHIPMENT AND WAS PRODUCED WITHOUT

USING OZONE DEPLETING SUBSTANCES OF CLASS I AND II.

RADIOACTIVITY CONTROL PERFORMED WITH A GAMMA SPECTROMETER: ASTM E181.

GAMMA ACTIVITY ON THE PRODUCTS BELOW 0.1 BQ/G ACCORDING TO EU RESOLUTION 2013/59/EURATOM , IAEA RS-G-1.7 AND IAEA SSG-17.





CERTIFICATE

A03/Z02

No. **A/21-956980**

Rev

00

Date 2021-05-24

Page

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A02/Z03

INSPECTION CERTIFICATE acc to
EN 10204 3.1

A06

THE METAL CENTRE
WESTERN WAY
WS10 7BW WEDNESBURY
UNITED KINGDOM

BOWL

CB-243079-01/20

Customer References C61858 - ROLLED	A07
180-00991 METAL CO-W	Customer order 2021-03-11

Sandvik References Order No. 567642 SMT No. 284-33699	A08
Subs No. 695687 C.Code 03	SMT Dispatch note 22007/53

Material description HOT WORKED BAR STEEL ROLLED ANNEALED & STRAIGHTENED PEEL TURNED AND POLISHED	B01/B04
Metallurgical process E+AOD+LRF	Origin Sweden C70

Steel/material Designations Sandvik SANMAC 316/SANMAC 316L	B02
AISI 316/316L	UNS S31600/S31603
W.nr 1.4401/1.4404	EN no 1.4401/1.4404

Technical requirements EN 10088-3:-2014, EN 10222-5:2017 (Chemicals and Mechanicals only) EN10272:-2016, EN 10088-5* NACE MR0175/ISO 15156-3:-2015, NACE MR0103/ISO 17945-1:-2015 ASTM A-276-17, ASME SA-276-ED-19 SECT II PART A, ASTM A-479-19, ASME SA-479-ED-19 SECT II PART A, ASTM A-484-20A, ASTM A-182-20*, Metal center specification GB01 Rev I, Sandvik DDR SP2016-03. NORSOK M-630 ED-6, NORSOK MDS S01 REV.5, *For detailed information, please see the appendix	B03
--	-----

EXTENT OF DELIVERY	B07-B13
It Product designation Heat Lot Pieces Kg	
04 MBRX-SANMAC316L-101.6 562005 44871 20 6606.0	
Total	20 6606.0

TEST RESULTS									
Chemical composition (weight%)									
Heat	C	Si	Mn	P	S	Cr	Ni	Mo	
562005	0.018	0.29	1.72	0.035	0.029	16.87	10.09	2.01	
	N								
562005	0.045								

Quality assurance - Erik Jansson/QA-manager Primary Products
MTC Service / Certificates

A05/Z02





CERTIFICATE

No. A/21-956980

Rev 00

Date 2021-05-24

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Tensile test at room temperature acc. to ASTM A370/ISO 6892-1

Longitudinal

Location half radius

Lot	Yield strength		Tensile strength	Elongation	
	Mpa	MPa	Mpa	%	%
44871	Rp0.2	Rp1.0	Rm	A	2"
	245	283	572	57	57
	Red.of Area				
	%				
	Z				
	80				

Hardness test acc.to ASTM A-370/ISO 6506-1

Location half radius

Lot	Min	Max
	44871	HB
	144	146
	Min	Max
Lot	HRB	HRB
44871	76	76

Grain size acc to ASTM E-112.

Location half radius

Lot		
44871	5.5	5.5

Impact test, J, Longitudinal acc. to ASTM A-370/ISO 148-1

Location half radius

Lot	Single values			Avg.	Temperature
	Joule			Joule	°C
44871	265	291	274	277	20
	268	269	273	270	20

Following controls/tests have been satisfactorily performed:

- Intergranular corrosion test acc to EN ISO 3651-2 Method A.
- Material Identification with spectroscopie.
- Ultrasonic test acc to EN 10308:2002, Quality Class 3
- Visual inspection and dimensional control.

HEAT TREATMENT:

20-30mm: Material soaking 1050°C, min. 20 minutes. Quenched in water.
Water temp pre-quench max 40°C, after quench max 50°C.

35-150mm: In process annealed according to ASTM A484 above the minimum hot rolling temperature of 1010°C and rapidly cooled.

155-350mm: Material soaking 1065°C, min. 30 minutes. Quenched in water. Water temp pre-quench max 40°C, after quench max 50°C.

355-370mm: Material soaking 1050°C, min. 60 minutes. Quenched in water. Water temp pre-quench max 40°C, after quench max 50°C.

375-450mm: Material soaking 1050°C, min. 120 minutes. Quenched in water. Water temp pre-quench max 40°C, after quench max 50°C.

The raw material is free from radioactive contamination.





Material free from mercury contamination.

No welding or weld repair.

This is to certify that the contents of this certified material test report are correct and accurate and that all test results and operations are in compliance with the material specification.

Certified acc. Pressure Equipment Directive (2014/68/EU Annex 1 para 4.3) TUEV CERT-Certification body for pressure equipment of the TUEV NORD GRUPPE; notified body, reg.-no. 0045.

The delivered products comply with the specifications and requirements of the order.

The material is manufactured according to a Quality system, approved and registered to ISO 9001:2015.

No unauthorized alterations. The contents of this Inspection Certificate may not be modified or revised in any way without the prior written approval of Sandvik Materials Technology. Unauthorized alterations to the Inspection Certificate, including introduction of false, fictitious or fraudulent statements or entries, may be punishable by fines, imprisonment, or both. This Inspection Certificate may be copied only in the manner and for the purposes specified in Section 6 of EN 10204:2004. Contravention of this notice will be prosecuted to the fullest extent of applicable law.

The certificate is produced with EDP and valid without signature.

APPENDIX

Lab accreditation

Our lab is accredited under SWEDAC Accreditation number 1636 for testing as per ISO/IEC 17025

Applicable only to specific dimensions

20mm - 250mm: EN 10088-5 EN (Only valid for CE marked products together with Sandvik Declaration of Performance certificate).

Suitable for manufacturing of components in acc. with *ASTM A-182.



APPENDIX C

Infinity Testing Solutions

3750B Laird Road, Unit 10, Mississauga, ON L5L 0A6, Canada
Tel: (905) 606 2288 Fax: (905) 606 2133



Hydrostatic Pressure Burst Tests

Report Number: 22010074

Quotation Number: P21-0287

Report for: **Round Engineering Inc.**
10 Segwun Rd.
Waterdown, ON L0R 2H6
Canada

Attention: Scott Islip, P. Eng.

Telephone: 905-689-9185

Report Date: April 11, 2022

1.0 INTRODUCTION

At request of Round Engineering Inc., Infinity Testing Solutions (ITS) conducted ambient pressure burst test for one (1) filter sample. The sample was assigned with ITS sample number and described as below. The test was performed on April 08th, 2022.

Sample Numbers	Description	Sample Receiving Date
22010074-1	Filter Hsg Model 180VP 1” NPT (1/2” NPT Drain)	2022-02-22

2.0 TEST APPARATUS

The test was performed on a computer-controlled servo hydraulic pressure testing system at ambient temperature. Test medium was city water. The sample had a properly sized fitting installed for pressure input, as seen in Figures section. The sample was pre-filled with city water and free of entrapped air before testing was performed.

3.0 TEST PROCEDURE

The test pressure was increased at a constant ramp rate until ultimate failure or leakage occurred. The pressure time history and maximum pressure was recorded by a precision pressure transducer.

4.0 RESULTS

The test results are listed in the following table:



Sample Number	Test Rate	Result	Figures
22010074-1	50 psi/s	Sample burst, maximum pressure achieved 21,943 psig	2,3

TSSA inspector, Mr. Amir Pourafshar (NB No. 16233), reviewed the test setup, verified the entire testing procedure, and signed the “Pressure Test Records” sheet as attached in Appendix A.

Infinity Testing Solutions Inc.

Prepared by:

Reviewed by:

Deep Shah, Test Technologist

Rob Banach, Lab Manager

This report refers only to the particular samples provided and is limited by the test and/or analysis performed. Similar articles may not be of like quality, and other testing and/or analysis methods might give different results.

Figures (2 Pages)



Figure 1: Sample 22010074-1 test setup



Figure 2: Sample 22010074-1 burst, maximum pressure achieved 21,943 psig

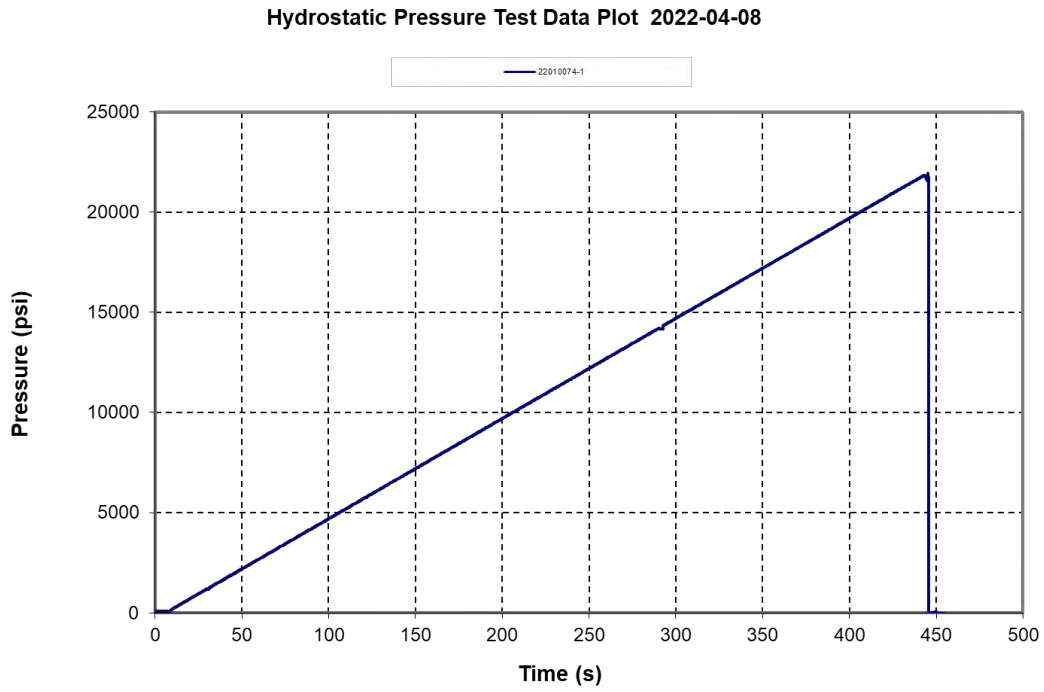


Figure 3: Sample 22010074-1 test pressure chart

APPENDIX A: PRESSURE TEST RECORD SHEET

(1 page)

Pressure Testing Records

Project Number	22010074
Client Name	Round Engineering

Sample Information:

Sample Number	Description
22010074-1	Filter Hsg Model 180VP 1" NPT (1/2" NPT Drain)

Test Results:

Sample No.	Test Rate	Result	Testing Date
22010074-1	50 psi/s	Sample burst, maximum pressure achieved 21,943 psig	2022-04-08


Testing performed according to ASME Sec.VIII Div.I, UG-101 (m).

Test Instrumentation:

Instrument Name	Range	ITS Instrumentation Number	Serial Number	Calibration Due
Stellar Pressure Transducer	0-60,000 psig	M0049	1308447	2023-01-20


Tested by:

Infinity Testing Solutions Inc.

 2022-04-08
 Deep Shah, Test Technologist


Reviewed by:

Infinity Testing Solutions Inc.

 2022-04-08
 David Wang, P.Eng.

Witnessed by:

TSSA

 APR. 08/22
 Amir Pourafshar NB No. 16233