VORTEX

SUBSEA SOLUTIONS

GAS / LIQUID SAMPLING TOOL
HYDRAULIC OPERATED

OPERATIONS MANUAL

VERSION	SECTION	ISSUE DATE	AUTHOR	DESCRIPTION OF UPDATE
1.0		20 April 2017	JG	First Edition

VOR-GST-MAN:VER 1.0VST-XX-LP-HYD

Vortex gas sample tool manual version1.0

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Contents

Introduction

The vortex Hydraulic Mini Gas Sampling tool is designed to capture gas and liquid samples in a subsea environment and recover said samples to the surface in a low pressure state of no more than 14psi (0.96bar) by means of an hydraulic mechanical operated syringe to ingest sample then purge sample into a sample bottle after recovery to surface.

This tool is designed to be deployed from the surface with the syringe bled of air immediately upon entering the water. Sample filling relies on the suck and blow pumping motion created by the syringe and associated relief valves. Sample taken can be discharged or cycled out of the syringe whilst under water if necessary.

1.1 REFERENCE DOCUMENTS

See Appendix and references section at the end of this document for certificates and manufacturers data.

1.2 ABBREVIATIONS

PSI: Pounds per Square Inch
PPE: Personnel protective equipment
JHA: Job Hazard Analysis
VST: Vortex Sample Tool
LP: Low Pressure

1.3 CONTACTS

For technical queries, comments and feedback contact Vortex Dredge: goodinjoe@gmail.com

Safety

2.1 OVERVIEW

All local HSE procedures must be followed. Use of PPE should follow guidelines outlined with handling of potential sample. For example hazardous gas samples should have PPE appropriate to mitigate dangers associated with that gas. Safety glasses should be considered minimum requirement irrespective of potential sample. Your safety is your responsibility. Think and plan ahead accordingly.

2.2 RISK ASSESSMENT

Consult with local HSE and installation operators to identify best practice steps needed for safe operations. Identify if the task been done and implement lessons learned. JHA, permitting and toolbox talks should preclude all operations.

2.3 MECHANICAL

Ensure all fittings and fasteners are secure. Check general condition of tool against images in manual for anything which may indicate potential operational issues.

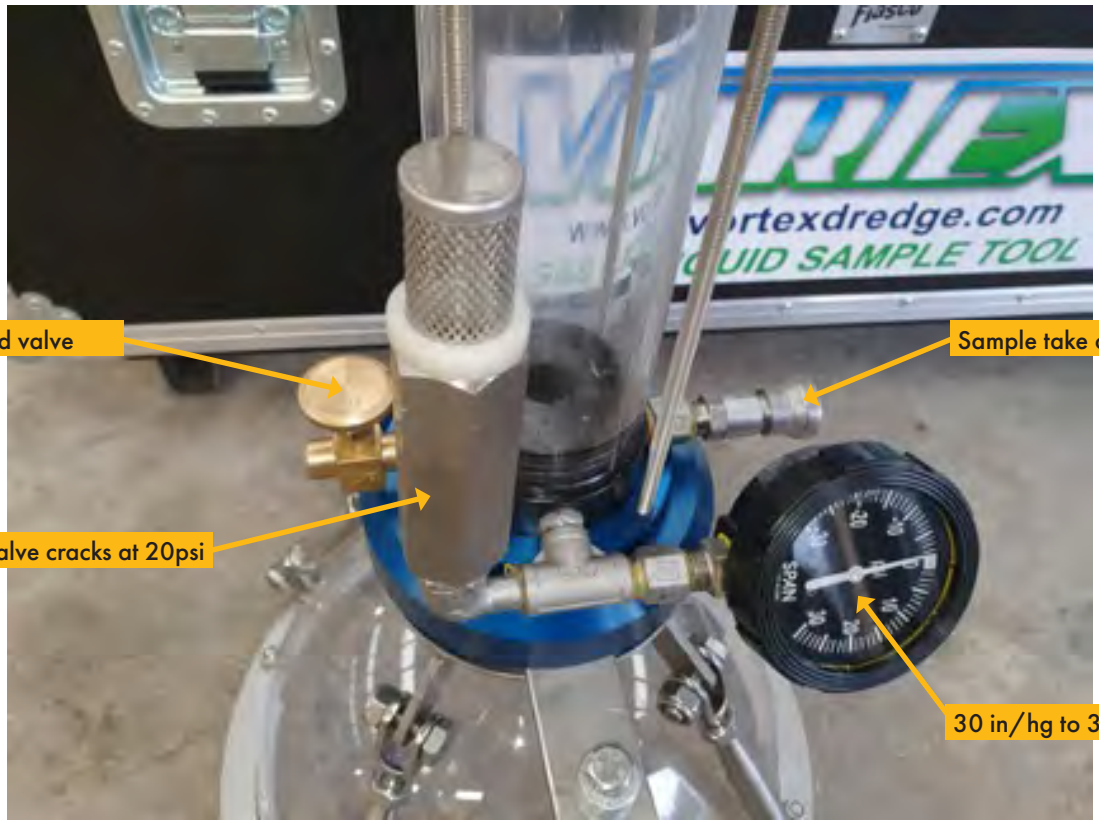
REMEMBER, YOUR SAFETY IS YOUR RESPONSIBILITY. THINK AND PLAN AHEAD ACCORDINGLY. IF IN DOUBT, PLEASE ASK.

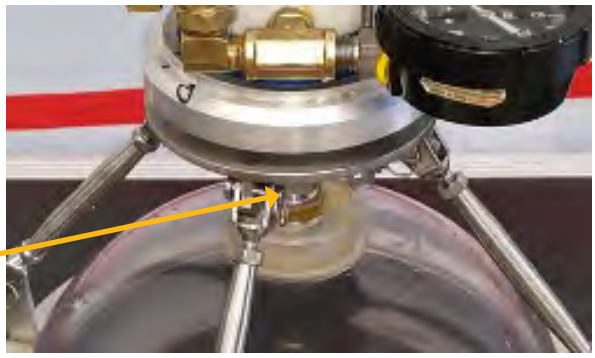
Technical Specifications

3.1 DESCRIPTION

To "Suck" the sample into the syringe the operator will function the hydraulic cylinder to draw the piston away from the check valves and draw a vacuum.

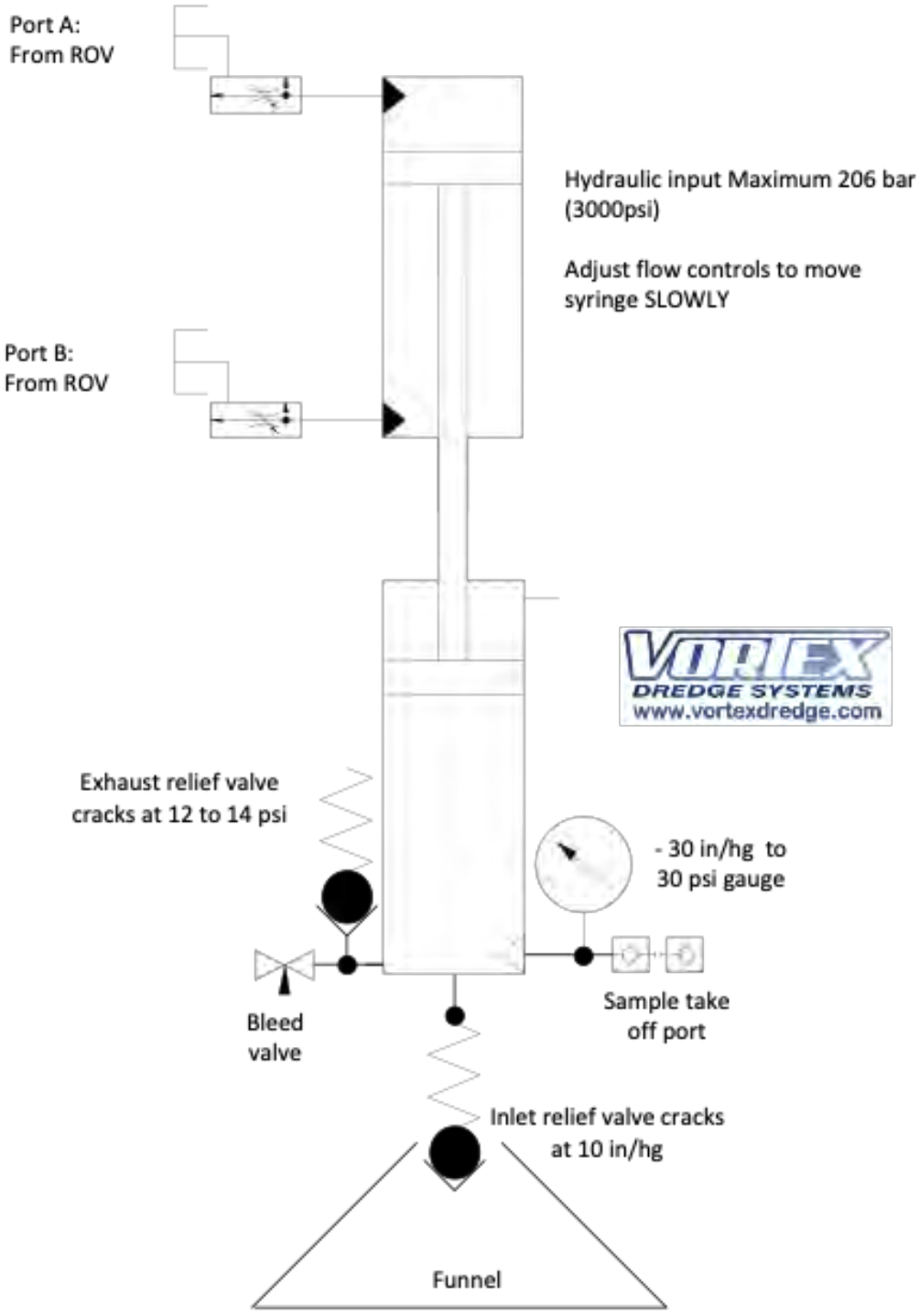
To "Blow" the sample out of the tool or into the sample bottle the operator will function the hydraulic cylinder towards the check valves – pushing the sample over the check valve and to atmosphere or into the sample bottle.





Technical Specifications

3.2 DESCRIPTION SCHEMATICS



Vortex VST-XX-LP-HYD sample tool schematic

Technical Specifications

3.2 HYDRAULIC CONNECTIONS

Supplied with tool are two -4 jic female swivel, 3000mm long 344bar (5000psi) rated hoses with flow control on each hose.

NOTE: Any questions on hydraulic power supply capabilities from your ROV, please consult the ROV manufacturer.

- Function A = Push or Blow product from syringe.
- Function B = Suck or ingest product into syringe.

Technical Specifications

3.3 COMPONENT PARTICULARS

- Complete tool Weight empty in air = 22lb (10kg)
- Syringe cylinder volume = 0.153 gallon (580 cc)
- Sample bottle volume = 0.264 gallon (1.0 litre)
- Main relief valve setting on syringe = 12psi (0.8 bar)
- Complete tool dimensions = 940 mm (37inch) overall height / tall x 460mm (18 inch) overall width.
- Discharging syringe into sample bottle typically captures 0.268 liter fresh water by volume with exhaust relief set at 20psi.
- Discharging syringe into sample bottle typically captures 0.523 liter of fresh air by volume with exhaust relief set at 20psi.
- Syringe body and end caps material: Acrylic
- Piston material: Acetal
- Piston rings / seals material: Nitrile 50 x 60 x 4
- Piston cap o-rings material : Nitrile N70
- Shipping box dimensions and weight = 148kg L100cm x W50cm x H 50cm.
- Depth rating = 3000 mtr. 9842 foot seawater

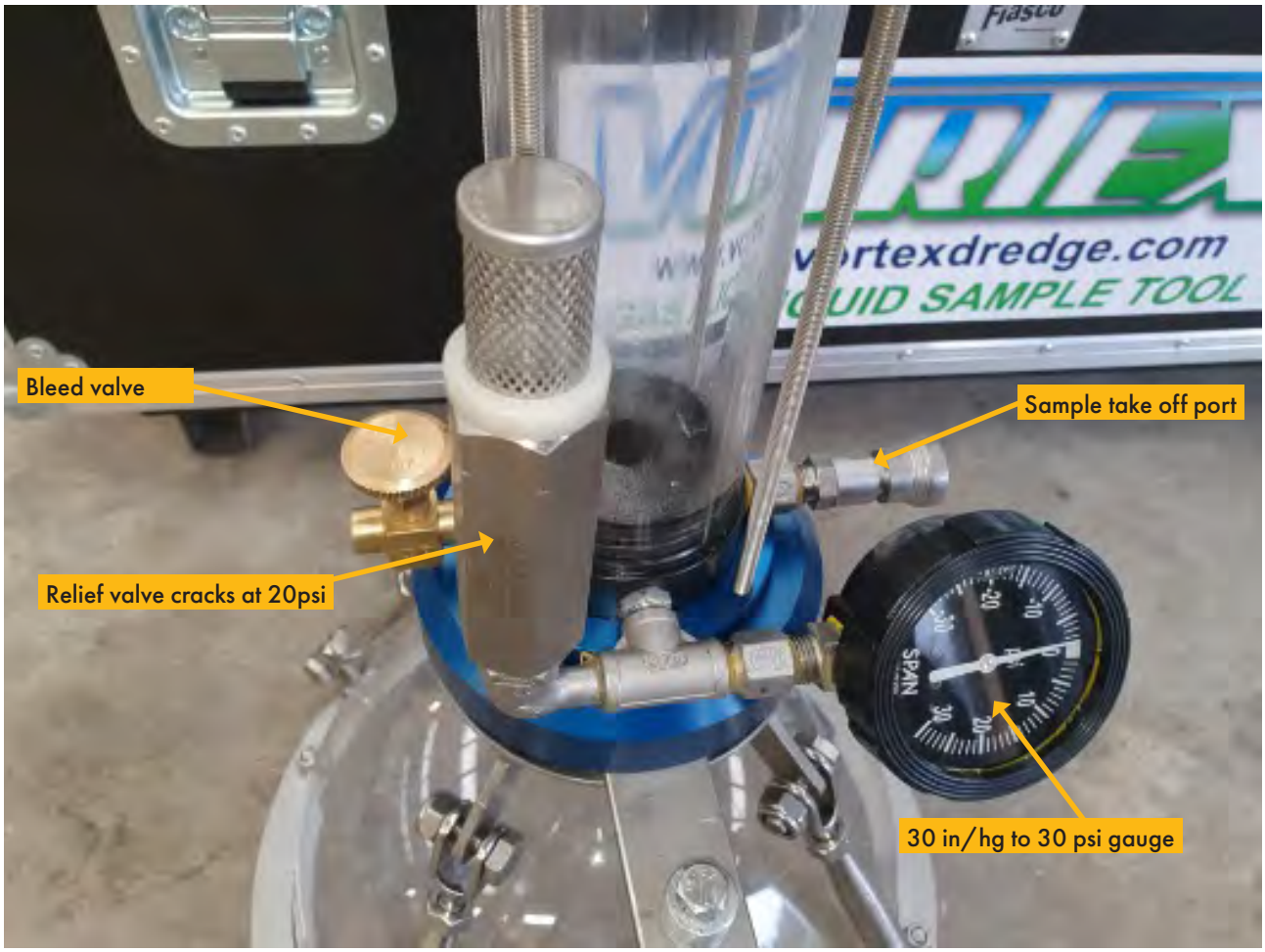
Operation Procedures

4.1 PRE DIVE CHECKS

STEP	PROCEDURE DESCRIPTION	CHECK
1	Check hydraulic connection between the tool and ROV. Consult ops manual for voltage figures and connections. See **TECHNICAL SPECIFICATIONS** in section 3. of this manual. Failure to provide correct pressures and connections as per manual can result in tool cable and motor failure.	
2	Check the piston full stroke in both directions in clear of obstructions. Connect water hose (fresh or salt) to inlet relief valve of tool, open bleed valve CW and purge water through the bleed valve and allow water to pass over the exhaust relief valve to expel any air in the system. Close bleed valve CCW. Launch with the piston at full stroke ready to ingest (piston at rest nearest the two check valves).	
3	Check the bleed valve is closed CCW. Failure to do so can result in insufficient syringe operation and sample being lost to ambient upon ascent.	
4	Check mechanical connections to the ROV are secure.	
5	Check 0 to 30 psi gauge is reading 0 and full of appropriate gauge liquid.	
6	Fit hose and funnel to inlet relief valve – adjust length of hose to suit. Secure funnel where appropriate to view sample being taken.	

Operation Procedures

4.1 PRE DIVE CHECKS (STEPS 2, 3 AND 5)



BLEED VALVE IS CLOCKWISE (CW) TO OPEN

AND COUNTERCLOCKWISE (CCW) TO CLOSE.

DO NOT OVER TIGHTEN.

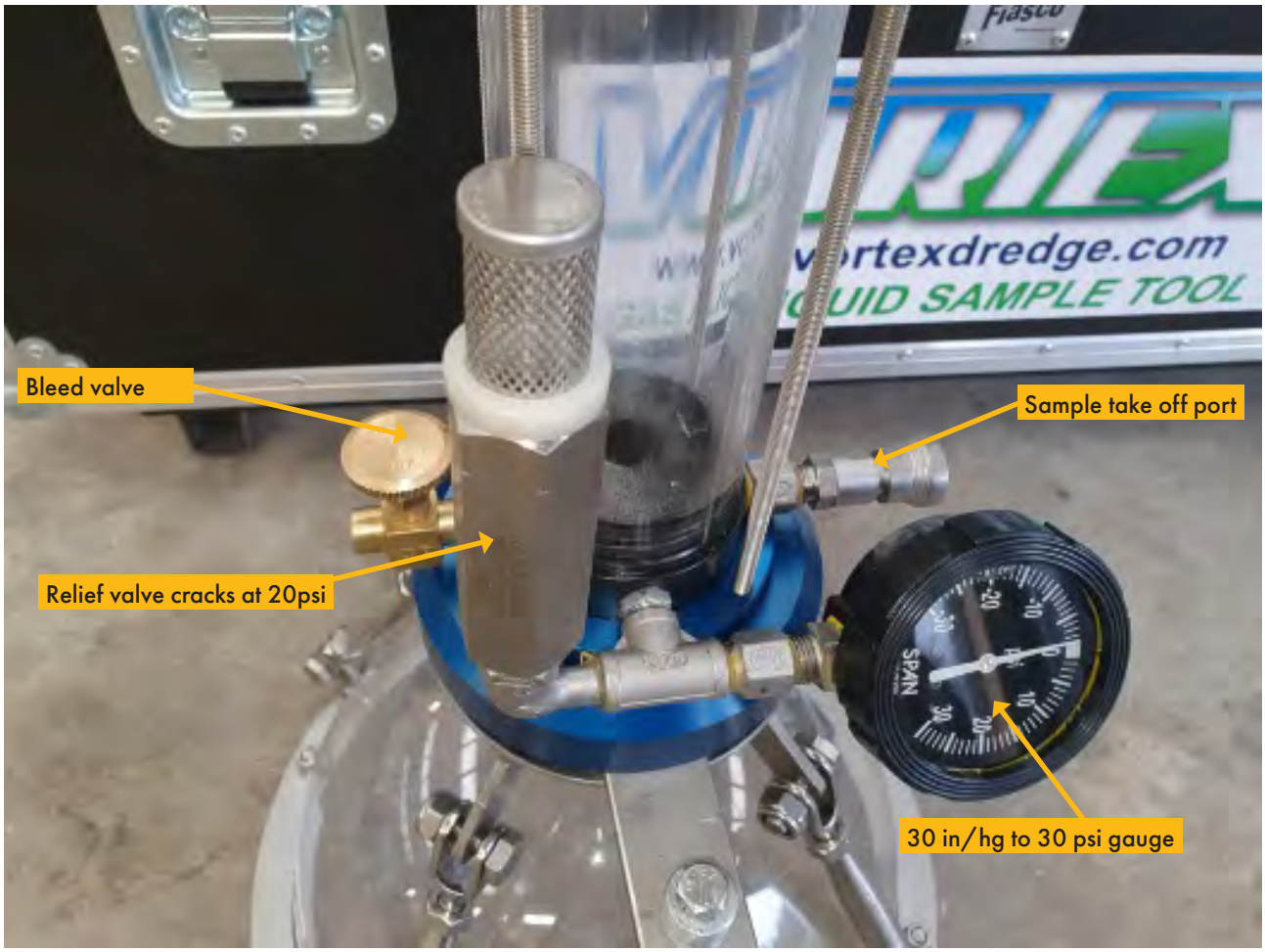
Operation Procedures

4.2 OPERATION PROCEDURE

STEP	PROCEDURE DESCRIPTION	CHECK
1	Launch with the piston at full stroke ready to ingest (piston at rest nearest the two check valves)	
2	Launch ROV to just below water surface to around 20mtr depth and fully function tool to both ends of stroke in sample cylinder to bleed out any ambient surface air from the system. Stroke tool to rest at full 'blow' position so it is ready to "suck" first sample.	
3	Check the bleed valve is closed CCW. Failure to do so can result in insufficient syringe operation and sample being lost to ambient upon ascent.	
4	Check mechanical connections to the ROV are secure.	

Operation Procedures

4.3 RECOVERY TO DECK



When recovering to deck, ascend as such a rate that the 0 to 30psi pressure gauge does not show over the 20 psi setting of the relief valve.

The relief valve is likely to purge excess pressure as gas expands during ascending irrespective of the rate of ascent.

Operation Procedures

4.4 REMOVAL OF GAS SAMPLE ON SURFACE

STEP	PROCEDURE DESCRIPTION	CHECK
1	Recover to deck. Ascend the tool and ROV at such a rate that the 0 to 30psi pressure gauge does not show over the 20 psi setting of the relief valve. The relief valve is likely to purge excess pressure as gas expands during ascending irrespective of the rate of ascent. **See 4.3 Recover to deck.**	
2	Exhaust relief valve is tasked with venting any excess pressure build up in the piston due to expanding gasses on recovery to a maximum of 20 psi (0.96bar).	
3	Pull a vacuum on the sample bottle using supplied vacuum pump. Connect bottle to vacuum pump, open bottle isolation valve, pull maximum vacuum, close bottle isolation valve to seal in vacuum. **See 4.4 Removal of gas sample on surface.**	
4	Connect sample bottle to tool as per instructions on **4.4 Removal of gas sample on surface.** NOTE: Ensure area is adequately ventilated to account for any gas going over the exhaust relief valve when filling bottle. Similarly, have appropriate containment under exhaust relief valve to catch any liquids. ALWAYS wear appropriate PPE and consult client for information on sample product and any appropriate safeguards.	
5	Flush the system with fresh water as per step below to resume sampling. Flush system with hot soapy water then fresh water between sample dives if required. Stroke piston "suck" and "Blow" 4 or 5 times to flush system. Check the piston full stroke in both directions in clear of obstructions. Connect water hose (fresh or salt) to inlet relief valve of tool, open bleed valve CW and purge water through the bleed valve and allow water to pass over the exhaust relief valve to expel any air in the system. Close bleed valve CCW. Launch with tool stroked to rest at full 'blow' position so it is ready to "suck" first sample.	

Operation Procedures

4.4 REMOVAL OF GAS SAMPLE ON SURFACE

Shown bottle and sample take off port.

Pull a vacuum on the sample bottle using supplied vacuum pump. Connect bottle to vacuum pump.

1. Open bottle isolation valve.
2. Pull maximum vacuum
3. Close bottle isolation valve to seal in vacuum.
4. Observe and note pressure gauge reading.
5. Connect sample bottle to sample bleed off connector
6. Open bottle isolation valve.
7. Function tool to 'blow' and discharge sample product into sample bottle.
8. Close bottle isolation valve.

NOTE: Ensure area is adequately ventilated to account for any gas going over the exhaust relief valve when filling bottle. Similarly, have appropriate containment under exhaust relief valve to catch any liquids.

ALWAYS wear appropriate PPE and consult client for information on sample product and any appropriate safeguards.

Operation Procedures

4.5 POST – DIVE CHECKS

STEP	PROCEDURE DESCRIPTION	CHECK
1	Check the piston full stroke in both directions in clear of obstructions. Open bleed valve slightly CW to allow hot soapy water to flush through bleed valve	
2	Connect hose from container of hot soapy water to inlet relief valve of tool and purge soapy water through the bleed valve and allow water to pass over the exhaust relief valve to flush salt water and traces of sample from the system. Stroke piston "suck" and "Blow" 4 or 5 times to flush system. Complete flushing with tool stroked to rest at full 'blow' position so it is ready to "suck" first sample.	
3	Check the bleed valve is closed CCW.	
4	Check mechanical connections on the tool are secure.	

Operation Procedures

4.5 POST – DIVE CHECKS

POST DIVE COMMENTS		
Name:	Signature:	Date:

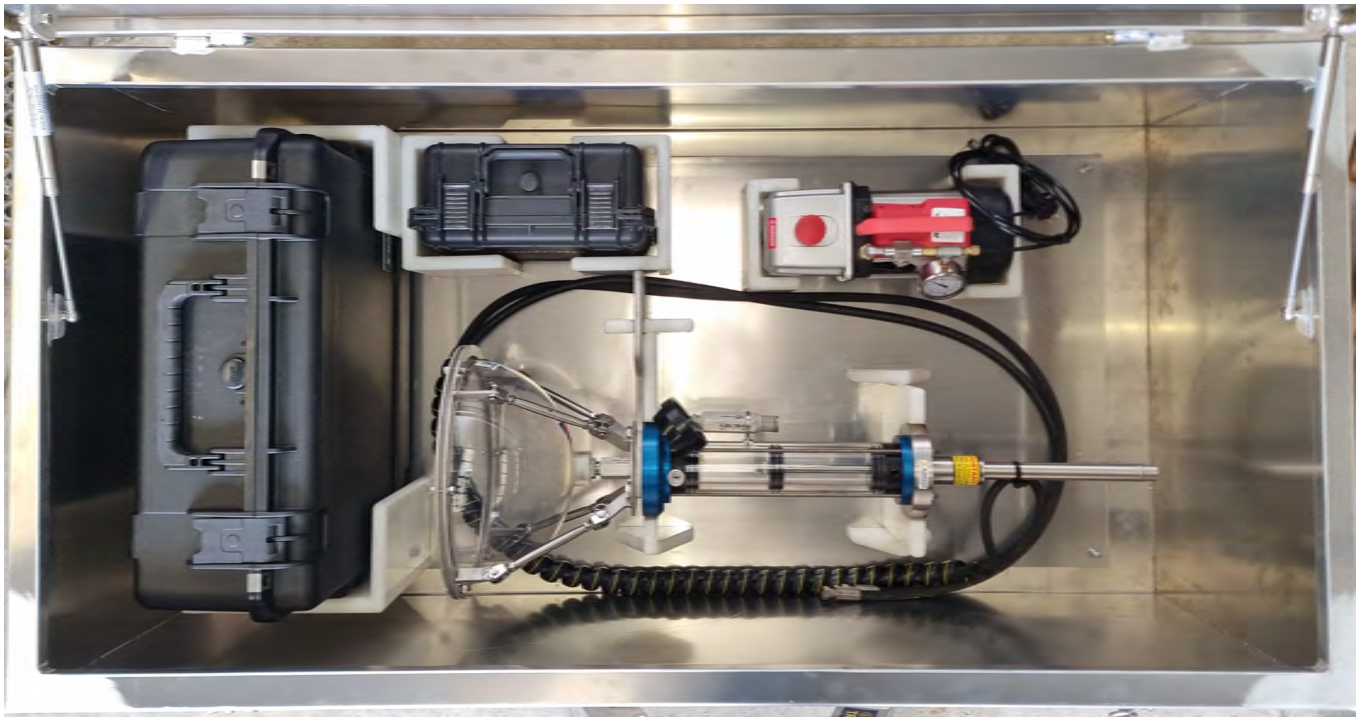
Maintenance & Storage

5.1 STANDARD PROCEDURES

- Tool should be flushed with hot soapy water as per post dive checks.
- Allow to dry fully.
- Check operational condition of hoses.
- Visual check of tool for anything which could prohibit future operation of the tool.

5.2 REPLACEMENT PROCEDURES

- Contact Ashtead Technology representatives with reports of any damaged or unserviceable items.



Shipping box dimensions and weight = 148kg L114cm x W80cm x H 70m

Appendix And References

APPENDIX I

6.1:1 TOOL DIMENSIONS AND WEIGHTS

Complete tool weight empty in air = 10kg (22lb)
Complete tool dimensions = 940 mm (37inch) overall height / tall x 460mm (18 inch) overall width.

SPARES

APPENDIX I

6.2 SPARES CONTENTS

1. Syringe ACRYLIC TUBE 70mm X 60mm x 280mm long
2. Item: OR053x4V75 53 x 4 Viton O-ring
3. Item: UM05006004 50 x 60 x 4 SA seal. Piston seals. (two items)
4. Cylinder seal kit.

Appendix And References

APPENDIX II

BOTTLE CERTIFICATES

Part No.: HSSC40-4BL
Report Date: 3/20/2013

ARROWHEAD INDUSTRIAL SERVICES USA, INC.
Compressed Gas Container Specialists
3537 S. NC 119, P.O. Box 1000
Graham, NC 27253-1000

Report No.: 2338
Sheet No.: 1
of 2

CERTIFICATE OF COMPLIANCE & TEST REPORT — SEAMLESS CYLINDERS

Manufactured for: Hoke Incorporated
405 Centnitura Court.
Location at: Spartanburg, SC 29303

Manufactured by: Luxfer Riverside
Location at: 3016 Kansas Ave.
Riverside, CA 92507

Consigned to: Hoke Incorporated
405 Centnitura Court,
Location at: Spartanburg, SC 29303

Quantity 27 Size **4.000** inches outside diameter by **9.50** inches long.

Specification: **DOT-3A1800** Identifying Symbol: **M5400**
Serial Numbers: **647 through 673** Exceptions: **none**
Inspector's Mark: A Tare Weights: **NO**
Test Date: **3-13** Lot Number: **30**

Marks stamped into the shoulder of the cylinders are: **DOT-3A1800 (SerNo) M5400** A **3-13 1000CC SS316**

Other Marks: **HOKE**

These containers were made by a process of spinning both ends to form a shoulder and neck of seamless steel tubing. The cylinders were heat treated for 15 minutes @ **775° F.** The material used was **316 stainless steel seamless tubing** and identified by the following heat number: V01054.

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers **were** marked on the material. All material, such as plates and seamless tubing were inspected and each cylinder was inspected both before and after closing in the ends; all that was accepted was found free from seams, cracks, laminations, and other defects which and after might prove injurious to the strength of the cylinder.

The process of manufacture and heat treatment of containers was supervised and found to be efficient and satisfactory. The cylinder walls were measured and the minimum thickness noted was **0.217** inch. The outside diameter was determined by a close approximation to be **4.000** inches. The wall stress was calculated to be **32,003** pounds per square inch under an internal test pressure of **3,000** pounds per square inch.

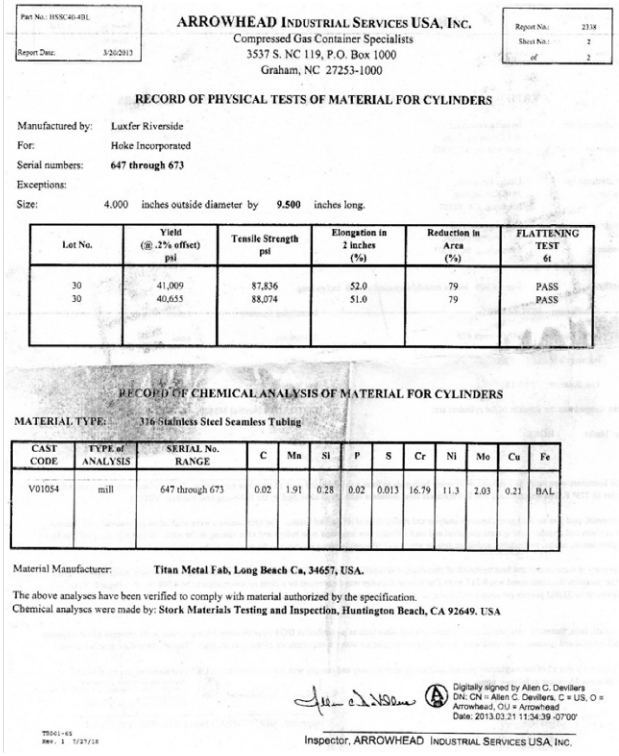
Hydrostatic tests, flattening tests, tensile tests of material, and other tests as prescribed in **DOT Specification 3A** were made in the presence of the inspector and all material and containers accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of **US Department of Transportation Specification 3A** except as follows: **none**

Digitally signed by Allen C. Devillers
DN: CN = Allen C. Devillers, C = US, O = Arrowhead, OU = Arrowhead
Date: 2013.03.21 11:34:22 -07'00'

Inspector, ARROWHEAD INDUSTRIAL SERVICES USA, INC.

TR223-95
Rev. 1 7/27/10



Part No.: HSSC40-4BL
Report Date: 3/20/2013

ARROWHEAD INDUSTRIAL SERVICES USA, INC.
Compressed Gas Container Specialists
3537 S. NC 119, P.O. Box 1000
Graham, NC 27253-1000

Report No.: 2338
Sheet No.: 2
of 2

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Manufactured by: Luxfer Riverside
For: Hoke Incorporated
Serial numbers: **647 through 673**
Exceptions:
Size: 4.000 inches outside diameter by **9.500** inches long.

Lot No.	Yield (@ .2% offset) psi	Tensile Strength psi	Elongation in 2 inches (%)	Reduction in Area (%)	FLATTENING TEST 6t
30	41,009	87,836	52.0	79	PASS
30	40,655	88,074	51.0	79	PASS

RECORD OF CHEMICAL ANALYSIS OF MATERIAL FOR CYLINDERS

MATERIAL TYPE: **316 Stainless Steel Seamless Tubing**

CAST CODE	TYPE of ANALYSIS	SERIAL No. RANGE	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	Fe
V01054	mill	647 through 673	0.02	1.91	0.28	0.02	0.013	16.79	11.3	2.03	0.21	BAL

Material Manufacturer: **Titan Metal Fab, Long Beach Ca, 34657, USA.**

The above analyses have been verified to comply with material authorized by the specification.
Chemical analyses were made by: **Stork Materials Testing and Inspection, Huntington Beach, CA 92649. USA**

Digitally signed by Allen C. Devillers
DN: CN = Allen C. Devillers, C = US, O = Arrowhead, OU = Arrowhead
Date: 2013.03.21 11:34:39 -07'00'

Inspector, ARROWHEAD INDUSTRIAL SERVICES USA, INC.

TR041-95
Rev. 1 7/27/10

Appendix And References

APPENDIX II

ACRYLIC TUBE PRESSURE CALCULATIONS

Programma di produzione standard

Tubi Acrilici Colati Esacast®

Diametro esterno mm.	Diametro interno mm.	Spessore di parete mm.
50	40-42-44	5-4-3
60	50-52-54	5-4-3
64	54-56-58	5-4-3
70	60-62-64	5-4-3
76	66-68-70	5-4-3
80	70-72-74	5-4-3
90	80-82-84	5-4-3
100	90-92-94	5-4-3
110	100-102-104	5-4-3
120	110-112-114	5-4-3
125	115-117-119	5-4-3
134	124-126-128	5-4-3
139	129-131-133	5-4-3
150	140-142-144	5-4-3
160	150-152-154	5-4-3
185	175-177-179	5-4-3
200	190-192-194	5-4-3
220	210-212-214	5-4-3
240	230-232-234	5-4-3
250	240-242-244	5-4-3
300	284-288-290-292	8-6-5-4
350	334-338-340-342	8-6-5-4
400	384-388-390-392	8-6-5-4
457	437-441-445-447	10-8-6-5
500	480-484-488-490	10-8-6-5

Standard production program

Cast Acrylic Tubes Esacast®

External diameter mm.	Internal diameter mm.	Wall thickness mm.
50	40-42-44	5-4-3
60	50-52-54	5-4-3
64	54-56-58	5-4-3
70	60-62-64	5-4-3
76	66-68-70	5-4-3
80	70-72-74	5-4-3
90	80-82-84	5-4-3
100	90-92-94	5-4-3
110	100-102-104	5-4-3
120	110-112-114	5-4-3
125	115-117-119	5-4-3
134	124-126-128	5-4-3
139	129-131-133	5-4-3
150	140-142-144	5-4-3
160	150-152-154	5-4-3
185	175-177-179	5-4-3
200	190-192-194	5-4-3
220	210-212-214	5-4-3
240	230-232-234	5-4-3
250	240-242-244	5-4-3
300	284-288-290-292	8-6-5-4
350	334-338-340-342	8-6-5-4
400	384-388-390-392	8-6-5-4
457	437-441-445-447	10-8-6-5
500	480-484-488-490	10-8-6-5

Appendix And References

APPENDIX II

ACRYLIC TUBE PRESSURE CALCULATIONS CONTINUED

Condizioni tecniche di fornitura

Lunghezze standard

fino al ø esterno 250 mm.	2.000 mm.
ø est. 300 mm.	1.000/2.030/**3.030** mm.
ø est. 400 mm.	1.000/2.030/2.160/**3.030** mm.
ø est. 500 mm.	1.000/2.030/2.180/**3.030** mm.

A richiesta per ø 200-220-240-250 è disponibile la lunghezza **3.030** mm.

Tolleranze sui diametri esterni

dal ø 50 mm. al ø 100 mm.	+1 / -1,5%
dal ø 110 mm. al ø 500 mm.	+1 / -1,5%

Tolleranze sullo spessore di parete

spessore 3 mm.	+/- 20 %
spessore 4 mm.	+/- 15 %
dallo spessore 5 mm. allo spessore 15 mm.	+/- 10 %

Tolleranze sulle lunghezze

+/- 1 mm.

Formula per il calcolo della pressione massima interna ammissibile

$$P^1 = \frac{50 \times S}{D^1}$$

dove:
P^1 = pressione interna del tubo in atmosfere o bar (1bar=0,1 N/mm²)
S = spessore del tubo in mm.
D^1 = diametro interno del tubo in mm.

Questa formula è valida in condizioni di test standard, e cioè ad una temperatura ambiente di 20 °C ed umidità relative del 50%.

Technical delivery terms

Standard lengths

up to the external ø 250 mm.	*2.000 mm.*
ext. Ø 300 mm.	*1.000/2.030/**3.030** mm.*
ext. Ø 400 mm.	*1.000/2.030/2.160/**3.030** mm.*
ext. Ø 500 mm.	*1.000/2.030/2.180/**3.030** mm.*

*On demand for ø 200-220-240-250 is available the length **3.030** mm.*

Tolerances on the external diameter

from ø 50 mm. up to ø 100 mm.	*+1 / -1,5%*
from ø 110 mm. up to ø 500 mm.	*+1 / -1,5%*

Tolerances on wall thickness

thickness 3 mm.	*+/- 20 %*
thickness 4 mm.	*+/- 15 %*
from thickness 5 mm. up to thickness 15 mm.	*+/- 10 %*

Lengths tolerance

+/- 1 mm.

Formula for the calculation of the maximum internal allowable pressure

$$P^1 = \frac{50 \times S}{D^1}$$

where:
P^1 = internal pressure of the tube in atmospheres or bar (1bar=0,1 N/mm²)
S = thickness of the tube in mm.
D^1 = internal diameter of the tube in mm.

This formula is valid for standard test conditions, and it means with 20 °C room temperature and 50% of relative humidity.

17

Appendix And References

APPENDIX II

ACRYLIC TUBE PRESSURE CALCULATIONS CONTINUED

Condizioni tecniche di fornitura

Lunghezze standard

fino al Ø esterno 40 mm.	2.000 mm.
oltre	2.050 mm.

Tolleranze sui diametri esterni

dal Ø 7 mm. al Ø 150 mm.	+/- 1 %
dal Ø 160 mm. al Ø 300 mm.	+/- 2 %

Tolleranze sui diametri interni

dal Ø 7 mm. al Ø 150 mm.	+/- 1,5 %
dal Ø 160 mm. al Ø 300 mm.	+/- 2,5 %

Tolleranze sullo spessore di parete

dal Ø 7 mm. al Ø 64 mm.	+/- 5 %
dal Ø 70 mm. al Ø 100 mm.	+/- 8 %
dal Ø 110 mm. al Ø 200 mm.	+/- 10 %
dal Ø 220 mm. al Ø 300 mm.	+/- 15 %

Tolleranze sulle lunghezze

+/- 1 mm.

Formula per il calcolo della pressione massima interna ammissibile

$$P^i = \frac{50 \times S}{D^i} \qquad \text{valida per } \frac{D^e}{D^i} \leq 1{,}2$$

dove:
P^i = pressione interna del tubo in atmosfere o bar (1bar=0,1 N/mm²)
S = spessore del tubo in mm.
D^e = diametro esterno del tubo in mm.
D^i = diametro interno del tubo in mm.

Questa formula è valida in condizioni di test standard, e cioè ad una temperatura ambiente di 20 °C ed umidità relativa del 50%.

Technical delivery terms

Standard lengths

up to the external Ø 40 mm.	*2.000 mm.*
over 40 mm.	*2.050 mm.*

Tolerances on the external diameter

from Ø 7 mm. up to Ø 150 mm.	*+/- 1 %*
from Ø 160 mm. up to Ø 300 mm.	*+/- 2 %*

Tolerances on the internal diameter

from Ø 7 mm. up to Ø 150 mm.	*+/- 1,5 %*
from Ø 160 mm. up to Ø 300 mm.	*+/- 2,5 %*

Tolerances on wall thickness

from Ø 7 mm. up to Ø 64 mm.	*+/- 5 %*
from Ø 70 mm. up to Ø100 mm.	*+/- 8 %*
from Ø 110 mm. up to Ø 200 mm.	*+/- 10 %*
from Ø 220 mm. up to Ø 300 mm.	*+/- 15 %*

Lengths tolerance

+/- 1 mm.

Formula for the calculation of the maximum internal allowable pressure

$$P^i = \frac{50 \times S}{D^i} \qquad \text{valida per } \frac{D^e}{D^i} \leq 1{,}2$$

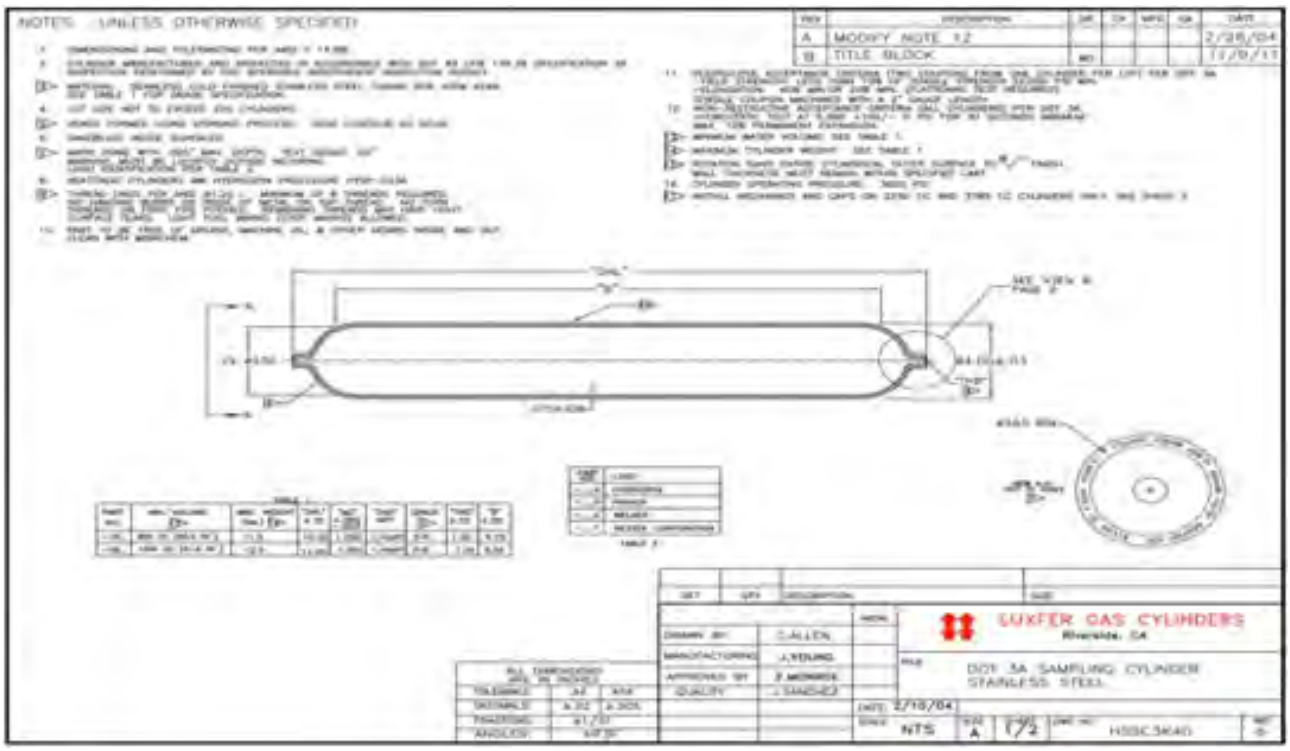
where:
P^i = internal pressure of the tube in atmospheres or bar (1bar=0,1 N/mm²)
S = thickness of the tube in mm.
D^e = external diameter of the tube in mm.
D^i = internal diameter of the tube in mm.

This formula is valid for standard test conditions, and it means with 20 °C room temperature and 50% of relative humidity.

Appendix And References

APPENDIX II

SAMPLE BOTTLE DETAILS



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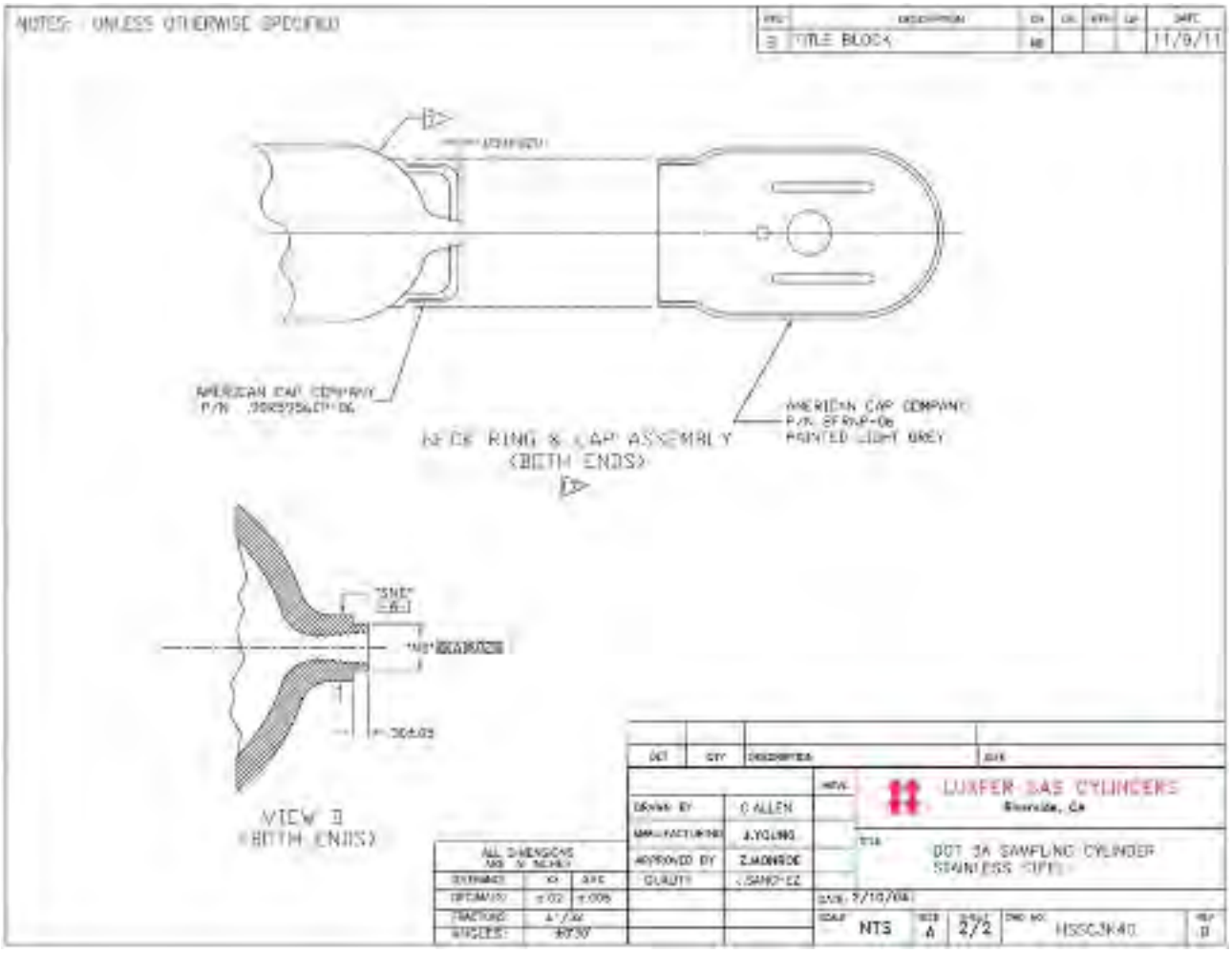

Appendix And References

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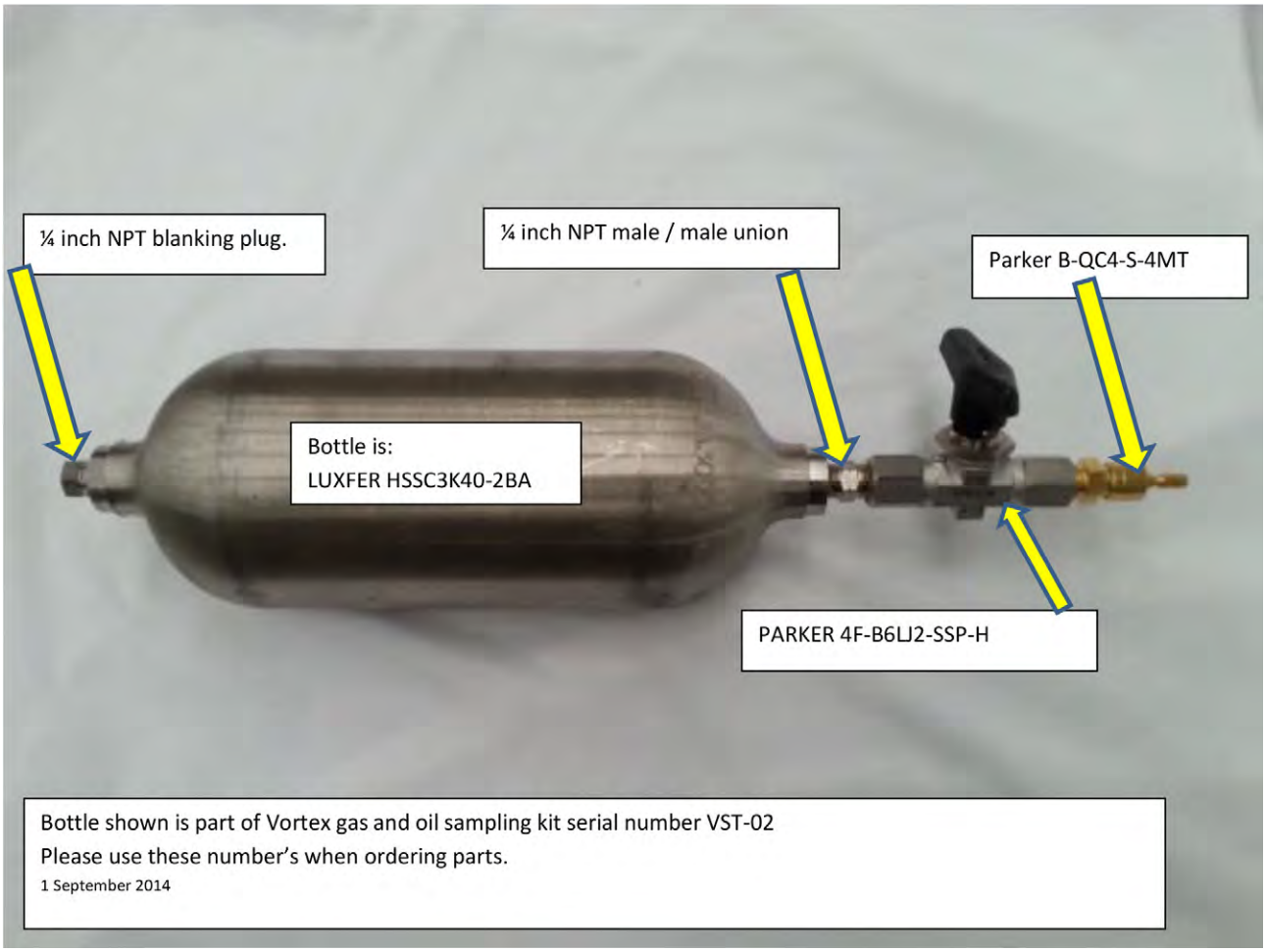


Appendix And References

APPENDIX II

SAMPLE BOTTLE DETAILS

Specification	DOT-3A1800 (NACE MR0175)
Volume	1000cc (0.264 gallon)
Test date	March 2013
Material	SS 316 L
Surface coating	N/A. Bare 316 stainless steel
Test pressure	Design test pressure of 3000 psi
Working pressure	Marked service pressure 1800 psi

It is YOUR responsibility to ensure transportation of equipment containing product and or samples complies with all relevant authorities.

Appendix And References

APPENDIX II

SAMPLE BOTTLE DETAILS

PART NUMBER	SERVICE PRESSURE	DIAMETER	LENGTH	WEIGHT	INTERNAL VOLUME	THREADS	SPECIFICATION	INCLUDED ACCESSORIES	MATERIAL
	bar	mm	mm	kg	ml				
HSSC3K15-3BA	207	38	221	0.6	150	.250-18 NPT	DOT-3A	-	316L Stainless
HSSC3K15-4BA	207	38	221	0.6	150	.375-18 NPT	DOT-3A	-	316L Stainless
HSSC30-1BA	207	76	173	2.3	300	.500-14 NPT	DOT-3A	-	316L Stainless
HSSC30-2BA	207	76	239	3.0	500	.500-14 NPT	DOT-3A	-	316L Stainless
HSSC30-3BA	207	76	417	5.6	1000	.750-14 NPT	DOT-3A		316L Stainless
HSSC3K40-1BA	207	102	260	5.2	900	.250-18 NPT	DOT-3A	Threaded cap & collar	316L Stainless
HSSC3K40-2BA	207	102	279	5.7	1000	.250-18 NPT	DOT-3A	Threaded cap & collar	316L Stainless

Appendix And References

APPENDIX II

CHECK VALVE DETAILS

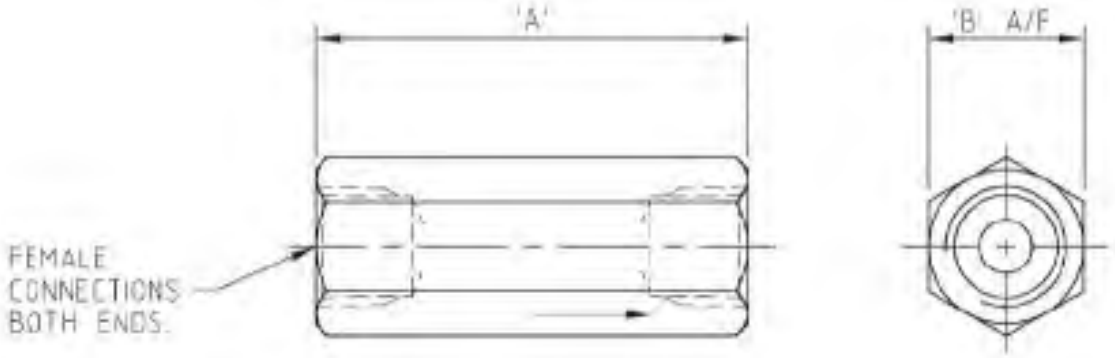
oliver valves
RELIABILITY UNDER PRESSURE

Product Data Sheet	Check Valve

Key features

- In-line poppet type
- Allows flow in one direction only, closing when flow reverses
- Max temperature 200℃
- VITON seats (VITON 90 available for NACE, KALREZ also available if required
- NPT female X female connections

General Arrangement Drawing

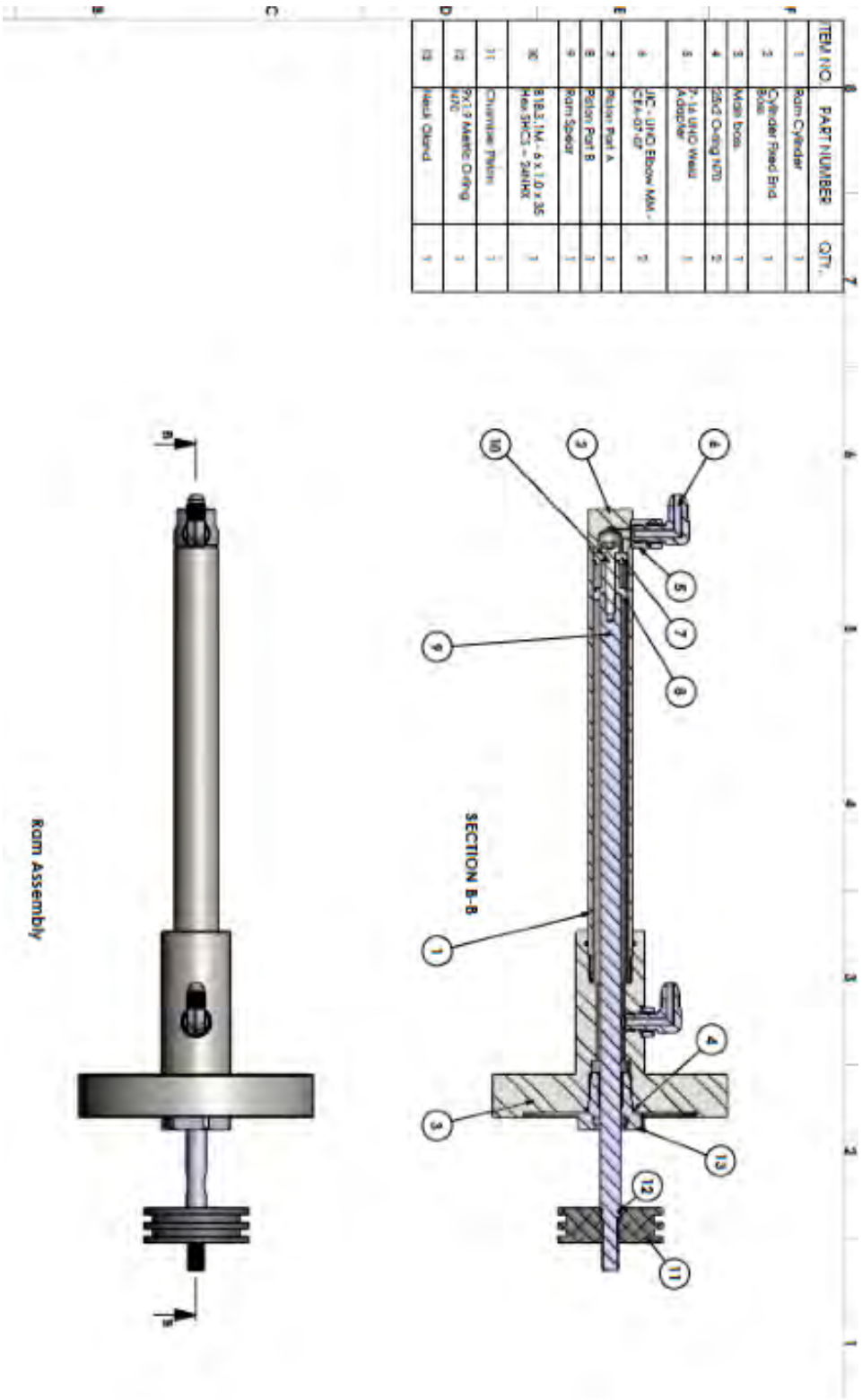


Sizes	Part No	Max Pressure	Cracking Pressure	A	B	Weight	CV (Max)
¼"	CV25S	6,000 PSI	7 PSI	0.87"	2.31"	0.2kg	0.7
⅜"	CV38S	6,000 PSI	7 PSI	1.10"	2.50"	0.3kg	0.7
½"	CV50S	6,000 PSI	7 PSI	1.10"	3.06"	0.3kg	2.0
¾"	CV75S	6,000 PSI	4 PSI	1.63"	3.63"	0.8kg	4.6
1"	CV10S	6,000 PSI	4 PSI	2.05"	4.19"	0.9kg	7.2

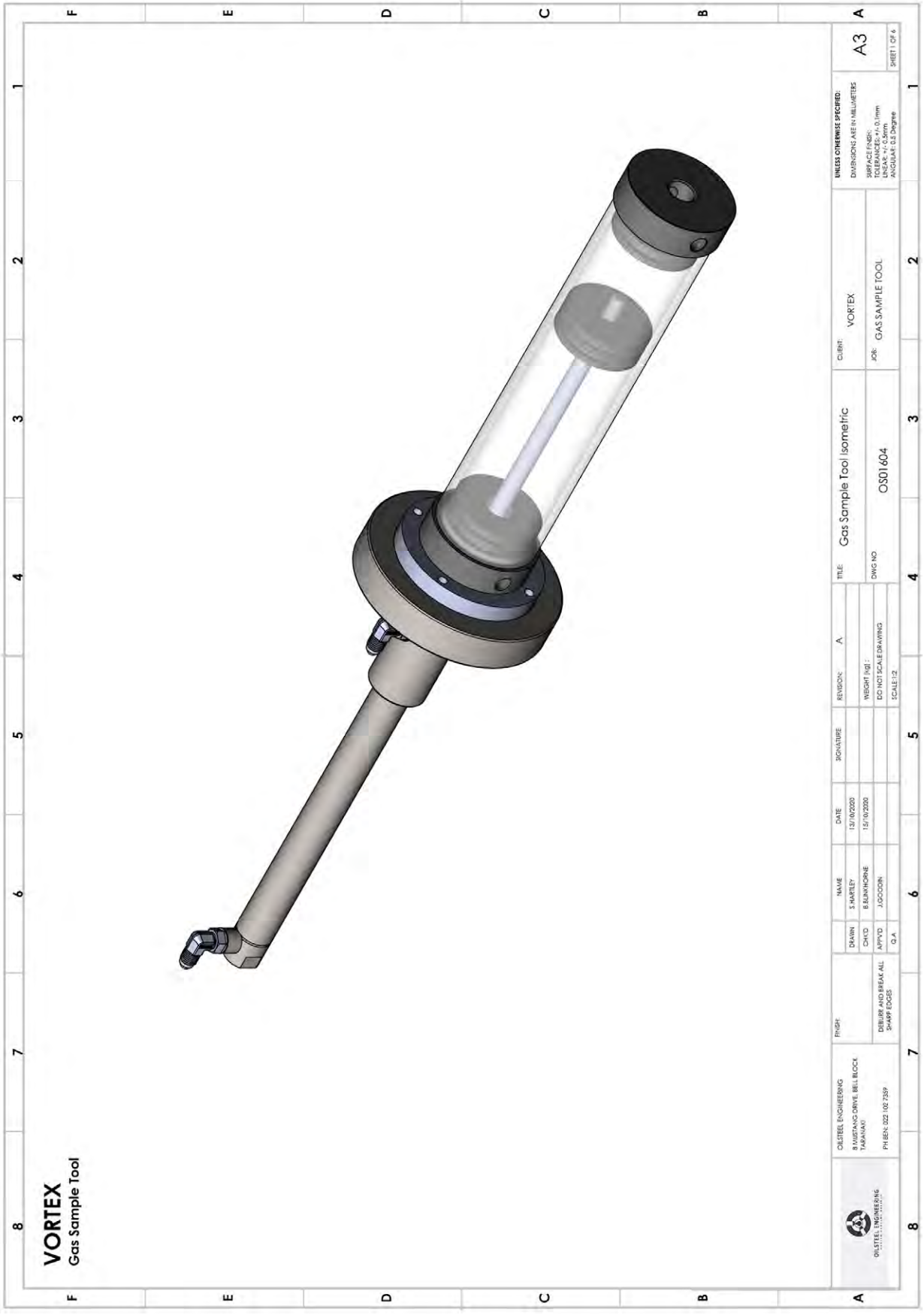
Appendix And References

APPENDIX II

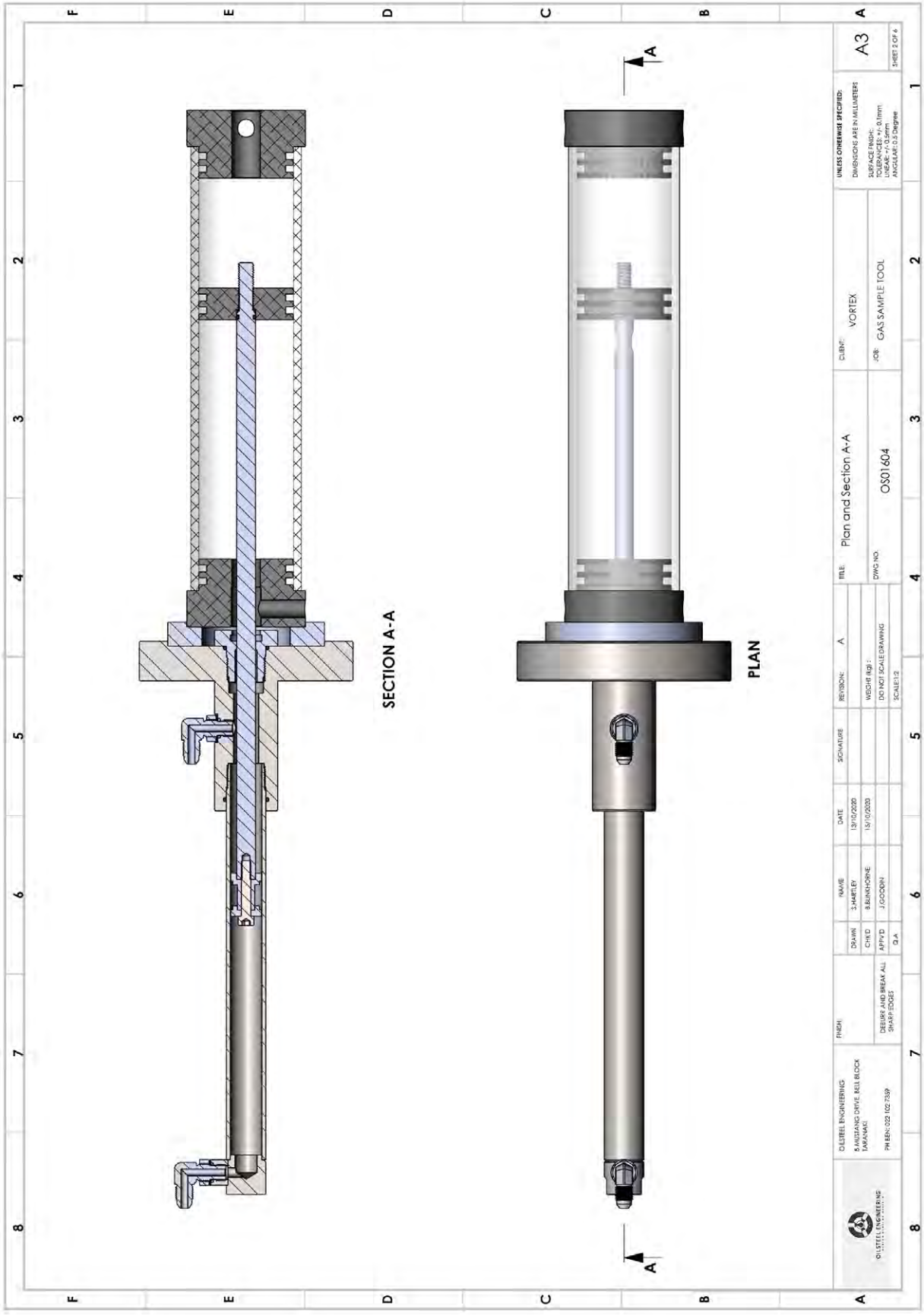
HYDRAULIC CYLINDER



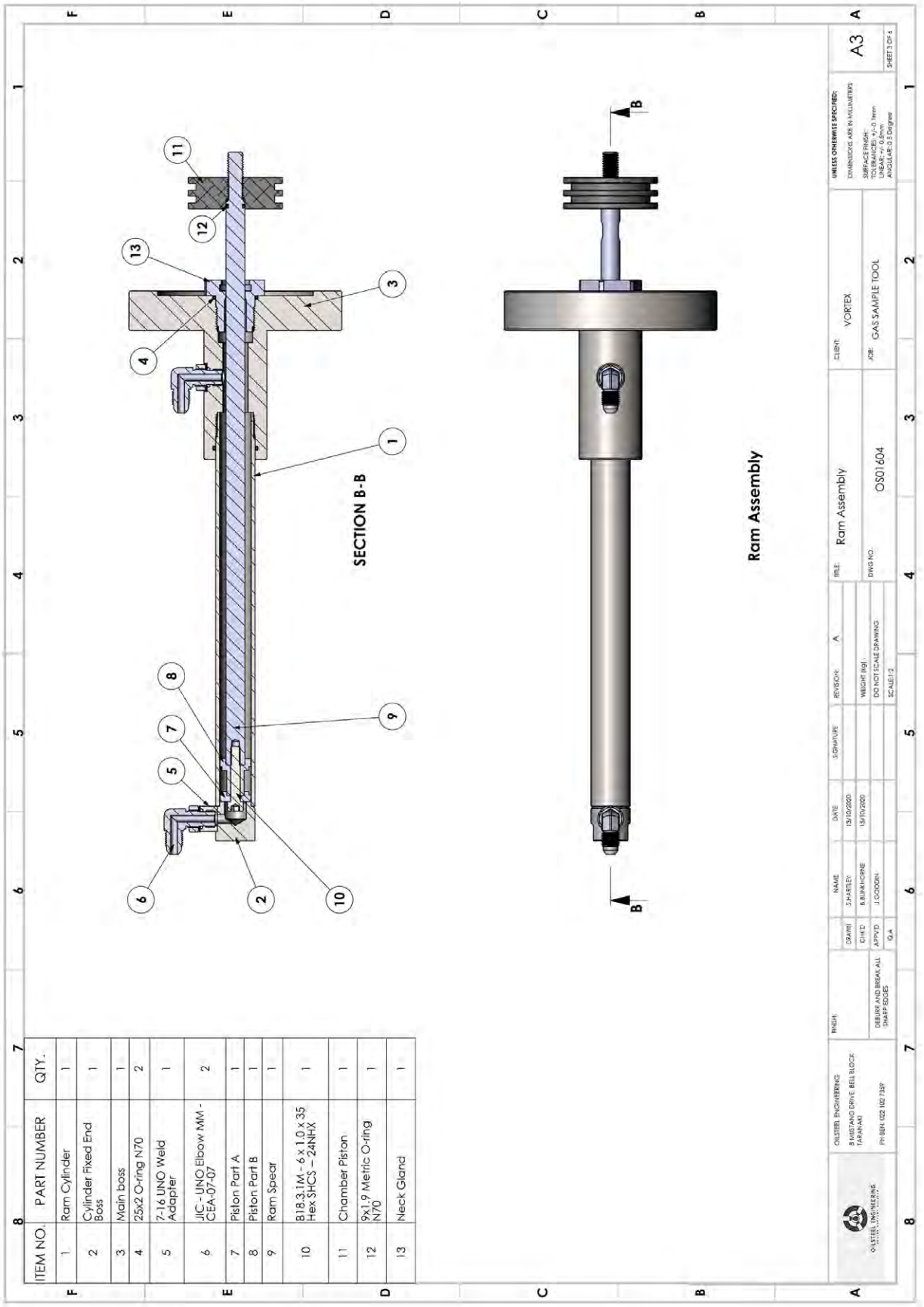
Gas Tool Schematics



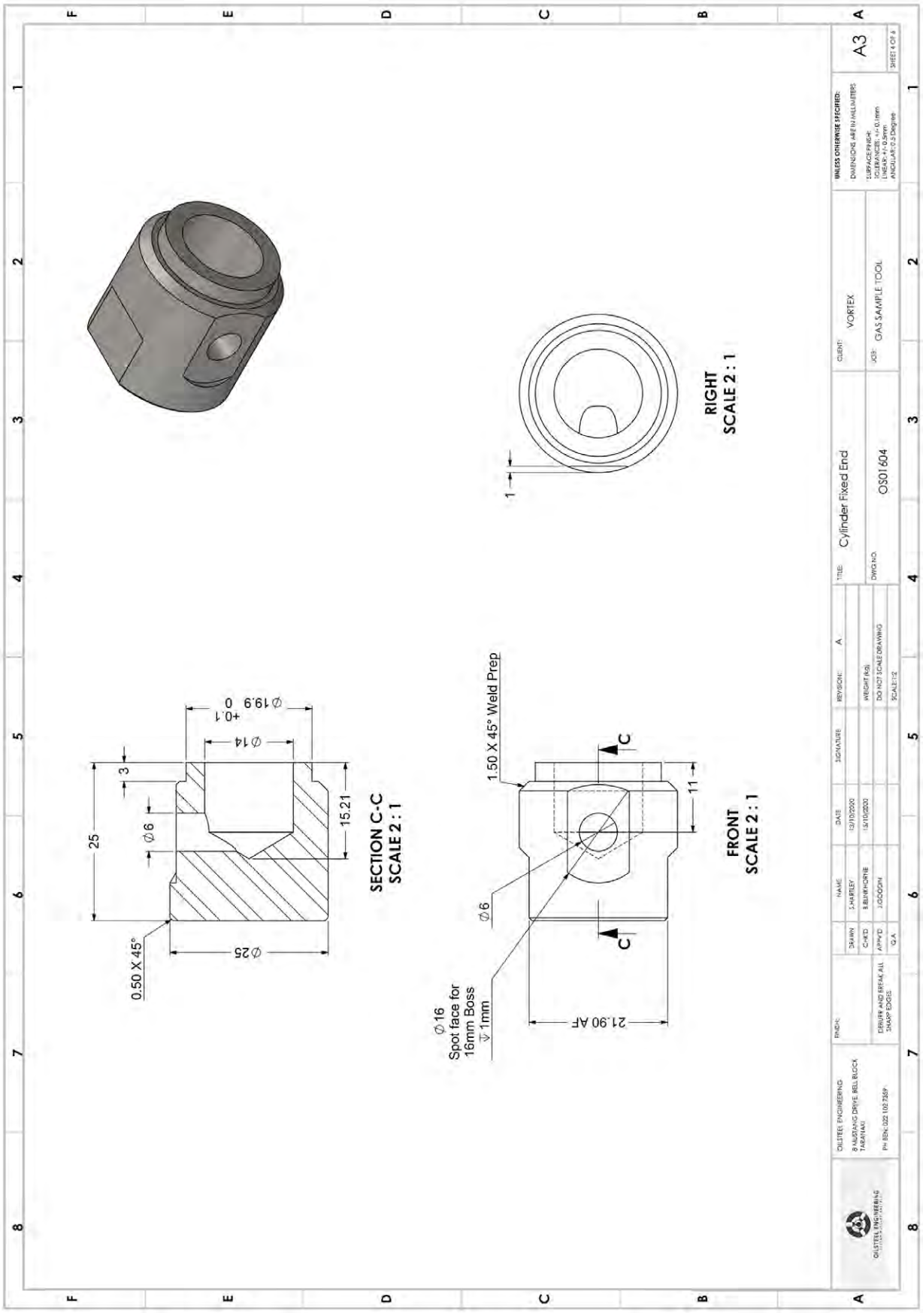
Gas Tool Schematics



Gas Tool Schematics



Gas Tool Schematics



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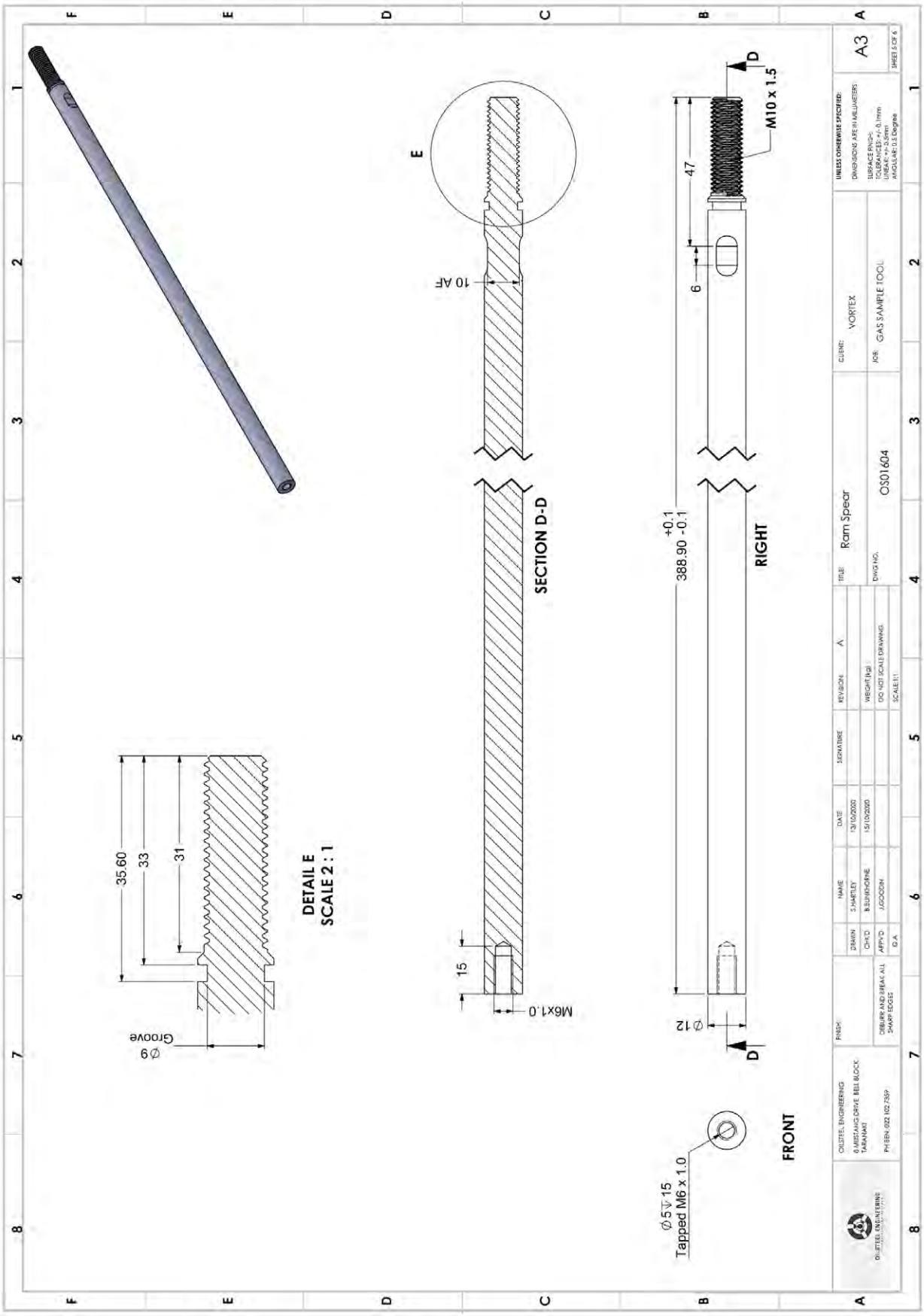
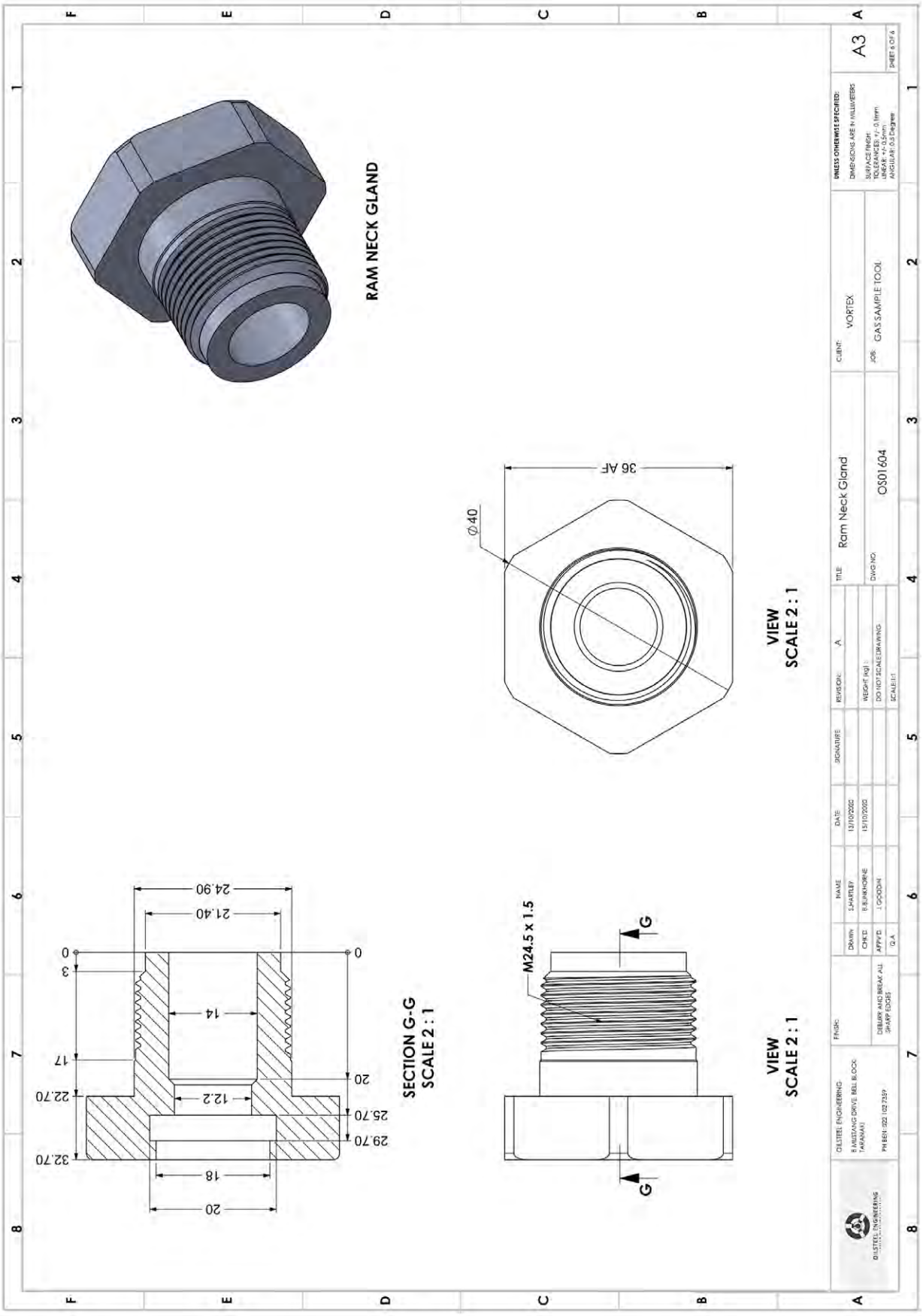


Gas Tool Schematics



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