

AUTOFLAME

**Valves and
Servomotors**

AUTOFLAME[®]



Valves and Servomotors



Issued by:

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Important Notes

A knowledge of combustion related procedures and commissioning is essential before embarking work on any of the M.M./E.G.A. systems. This is for safety reasons and effective use of the M.M./ E.G.A. system. Hands on training is required. For details on schedules and fees relating to group training courses and individual instruction, please contact the Autoflame Engineering Ltd. offices at the address listed on the front.

Short Form - General Terms and Conditions

A full statement of our business terms and conditions are printed on the reverse of all invoices. A copy of these can be issued upon application, if requested in writing.

The System equipment and control concepts referred to in this Manual MUST be installed, commissioned and applied by personnel skilled in the various technical disciplines that are inherent to the Autoflame product range, i.e. combustion, electrical and control.

The sale of Autoflame's systems and equipment referred to in this Manual assume that the dealer, purchaser and installer has the necessary skills at his disposal. i.e. A high degree of combustion engineering experience, and a thorough understanding of the local electrical codes of practice concerning boilers, burners and their ancillary systems and equipment.

Autoflame's warranty from point of sale is two years on all electronic systems and components.

One year on all mechanical systems, components and sensors.

The warranty assumes that all equipment supplied will be used for the purpose that it was intended and in strict compliance with our technical recommendations. Autoflame's warranty and guarantee is limited strictly to product build quality, and design. Excluded absolutely are any claims arising from misapplication, incorrect installation and/or incorrect commissioning.

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1 FUEL CONTROL VALVES

The standard execution of the gas valve is an aluminium body with stainless steel metering disk and stem. The gas valves can also be supplied for corrosive/contaminated fuels in all stainless steel construction. Price on application.

When using high viscosity low temperature fuel oils through smaller valves, turbulent flow characteristics can reduce volume throughput significantly.

All flow pressure graphs published for oil valves are using light distillate oil @ 20°C and a viscosity of 5 centistokes.

Autoflame will carry out flow characteristics test on specific valves against customer fuel/ viscosity and temperature specifications. Price on application.

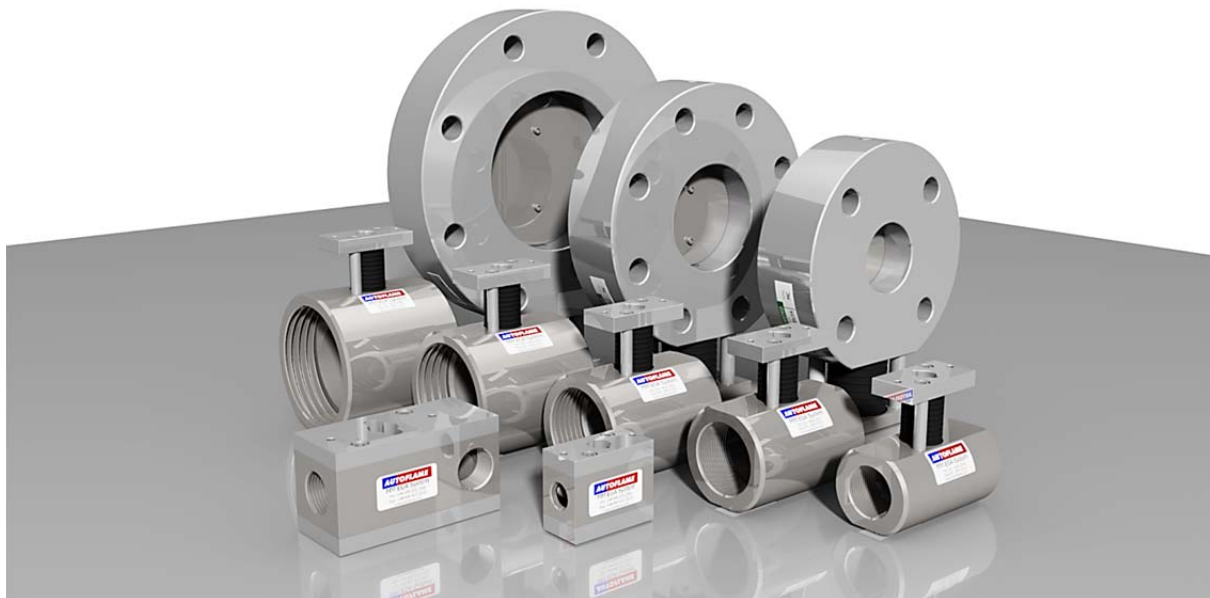
Standard oil valve build execution is stainless steel valve body with stainless steel bobbin. The top and bottom closing plates are manufactured out of aluminium.

All valves can be supplied in non-standard material at extra cost. Price on application.

The standard execution of the FGR valve (flue gas recirculation) is a stainless steel body with stainless steel disk and stem but is dependent upon the application. Two grease nipple points are used for easy service of the FGR valves.

The maximum pressure for the control valves are:

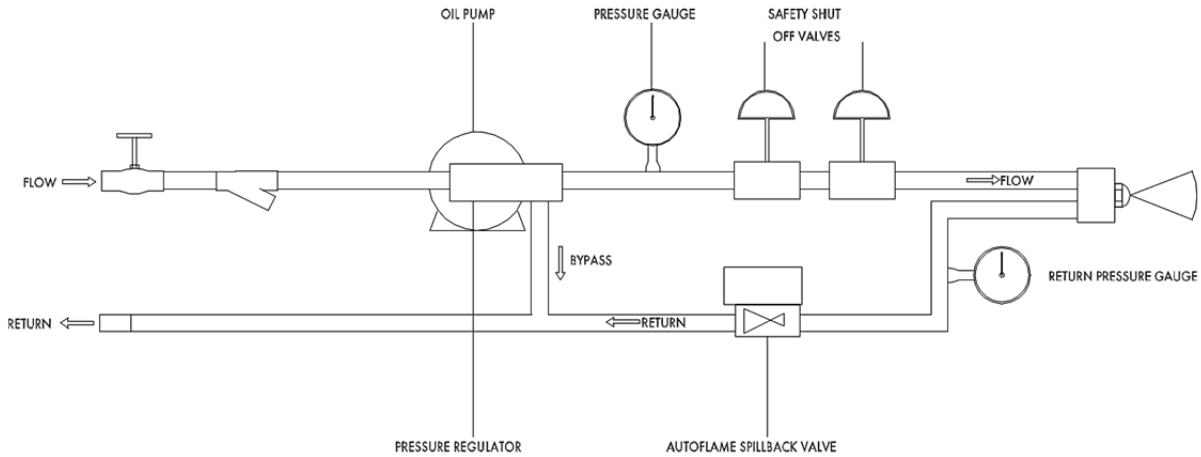
- 350 PSI for oil valves
- 10 PSI for threaded gas valves
- 25PSI for flanged gas valves



1.1 Oil Valve Sizing

1.1.1 Spillback/ Bypass Application

To size an oil valve for a spillback/by pass application, please refer to the schematic and table below.



Information Required	Actual Data	Typical Data
Oil Pump Flow		1.6X Nozzle size
Oil Pump Pressure		350 to 450 PSI
Solenoid Delta P. (both valves)		4 to 20 PSI
Nozzle Maximum Working Pressure		300 PSI
Nozzle Size (lb/hr)		1000 lb/hr
Return Oil Pressure at Low Fire		80 to 120 PSI

When sizing the oil valve for bypass systems. We have to determine the amount of oil being returned to the pump/tank at low fire and at what pressure. This information is then used against the valve charts in the Section 1.1.3. At low fire, the valve is most open and producing maximum flow.

Based on the above example:

$$\begin{aligned}
 1000\text{lb/hr} \times 1.6 &= 1600\text{lb/hr} \\
 \text{Low fire oil requirement} &= 250\text{lb/hr (based at 4:1 turndown = } 1000/4) \\
 1600\text{lb/hr} - 250\text{lb/hr} &= 1350\text{lb/hr} \\
 \text{Spillback oil flow} &= 1350\text{lb/hr @ 100PSI}
 \end{aligned}$$

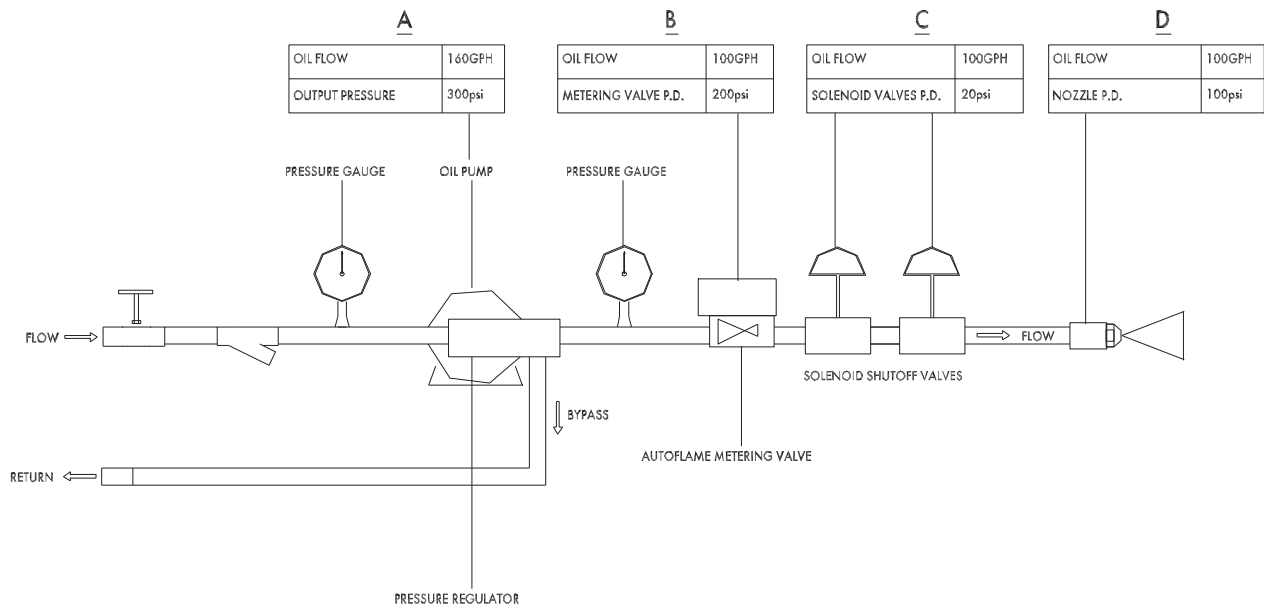
Therefore, based on the charts in Section 1.1.3, the correct valve would be type 5.

For the spillback flow at that return oil pressure at low fire, choose the valve which allows the maximum movement in degrees for control. The valves should be chosen for the most open to the low fire position for the spillback valve.

1 Fuel Control Valves

1.1.2 Metering/Simplex Application

To size an oil valve for a spillback/by pass application, please refer to the schematic and table below.



Sizing Method

The following must be completed before the oil valve can be correctly sized for the pressure drop, at the metering valve. Together with the maximum oil flow, this will determine the valve required, based on the charts in section 1.1.3.

$$A - C - D = B$$

A = Output pressure at regulator

C = Solenoid valves pressure difference

D = Nozzle pressure difference

Example:

Known parameters are pump max flow and pressure output. To determine the flow and pressure drop across the nozzle:

The difference between Valve A, C and D is applied to the charts in Section 1.1.3.

$$A = 300\text{PSI}$$

$$C = 20\text{PSI}$$

$$D = 100\text{PSI}$$

$$B = 300\text{PSI} - 20\text{PSI} - 100\text{PSI} = 180\text{PSI pressure difference}$$

So the valve required needs to meet an oil flow of 100GPH @ 180PSI P.D.

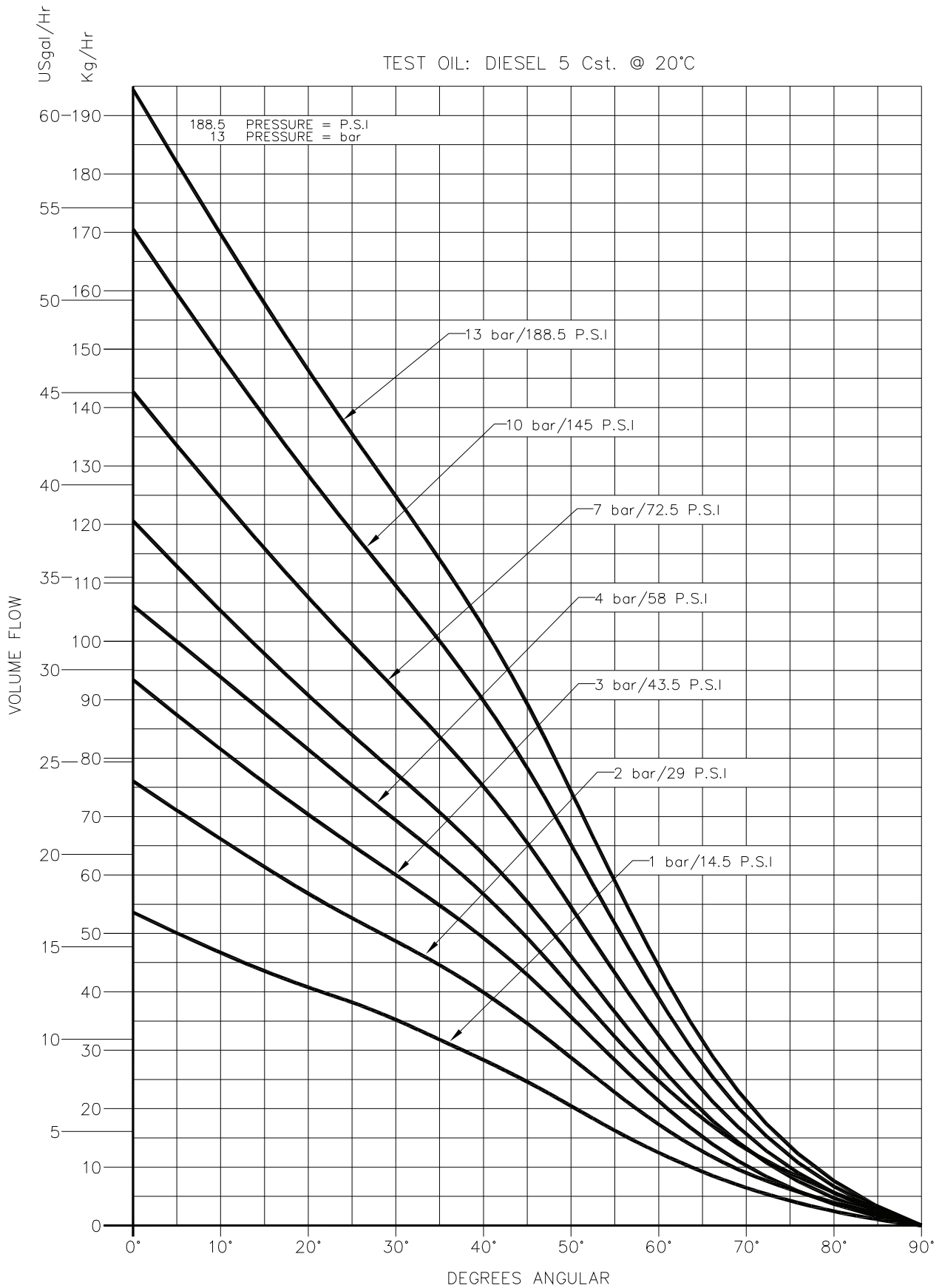
For the metering valve choose the valve which gives the maximum movement degrees of control. The valve should be chosen for the most open to high fire.

1 Fuel Control Valves

1.1.3 Oil Valve Flow Characteristics

Type 1: OVS31015 - Spillback/ Bypass

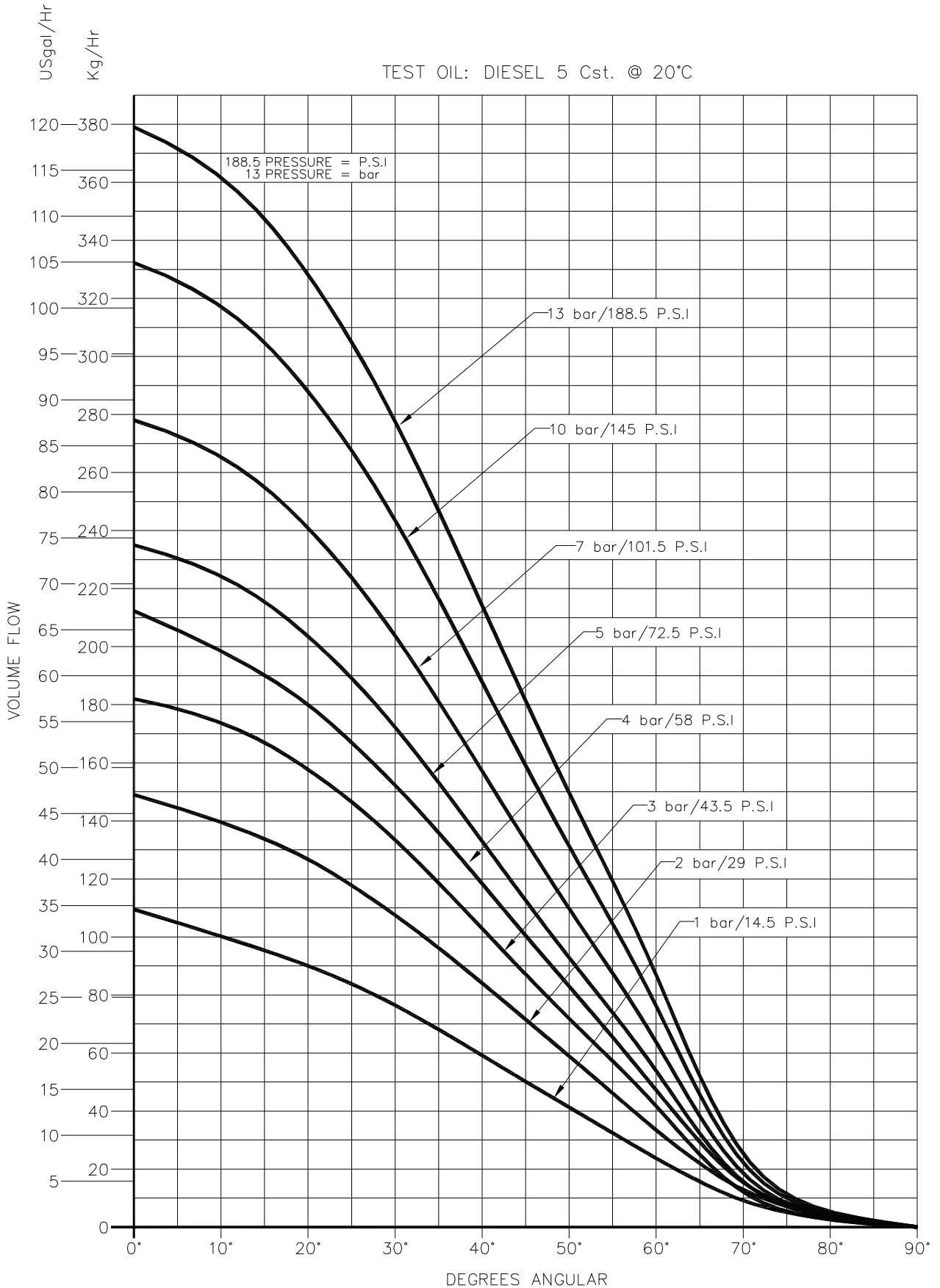
(OVM31015 - Metering/ Simplex)



1 Fuel Control Valves

Type 2: OVS32016 - Spillback/ Bypass

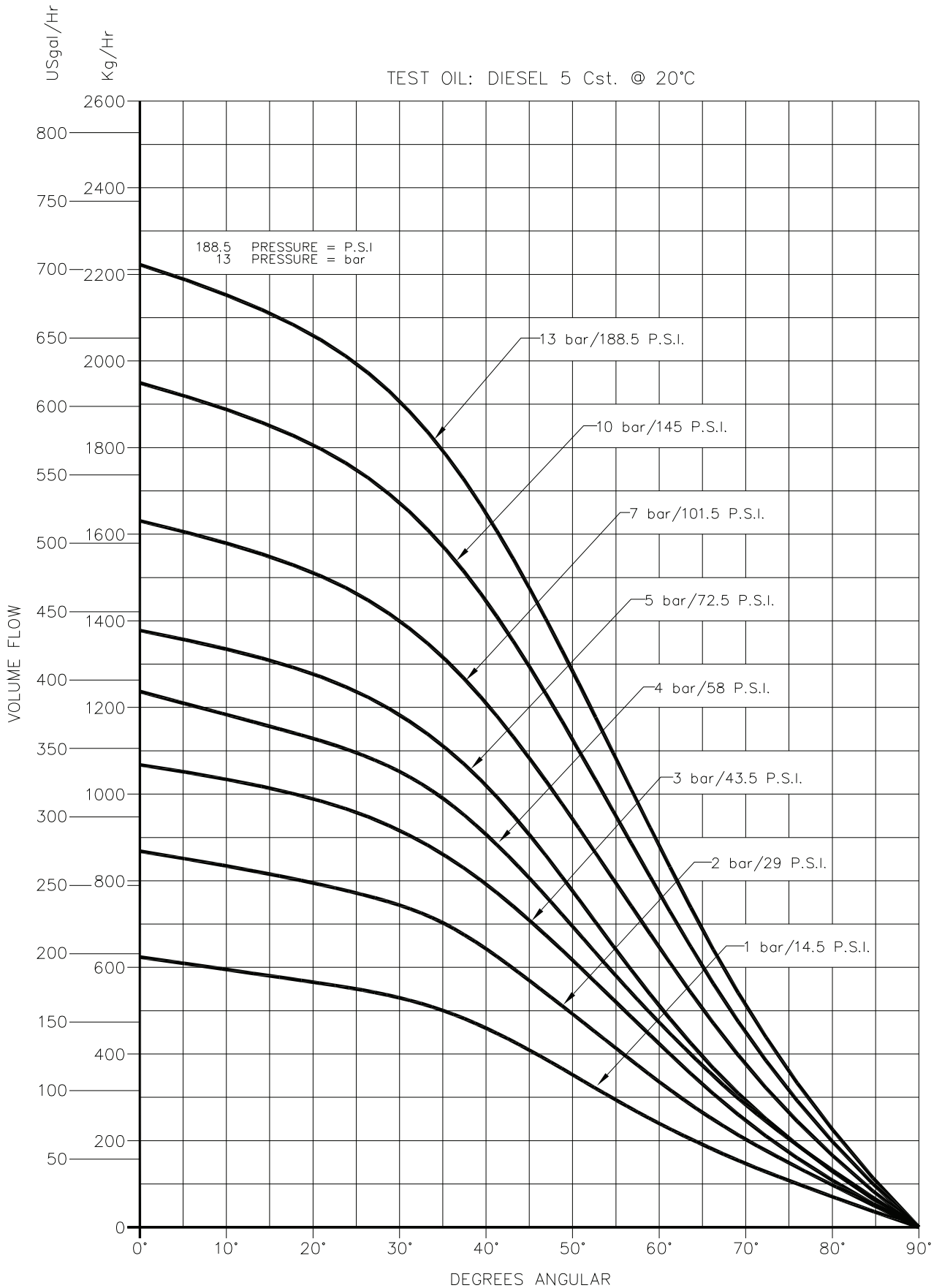
(OVM32016 - Metering/ Simplex)



1 Fuel Control Valves

Type 4: OVS34L18 - Spillback/ Bypass

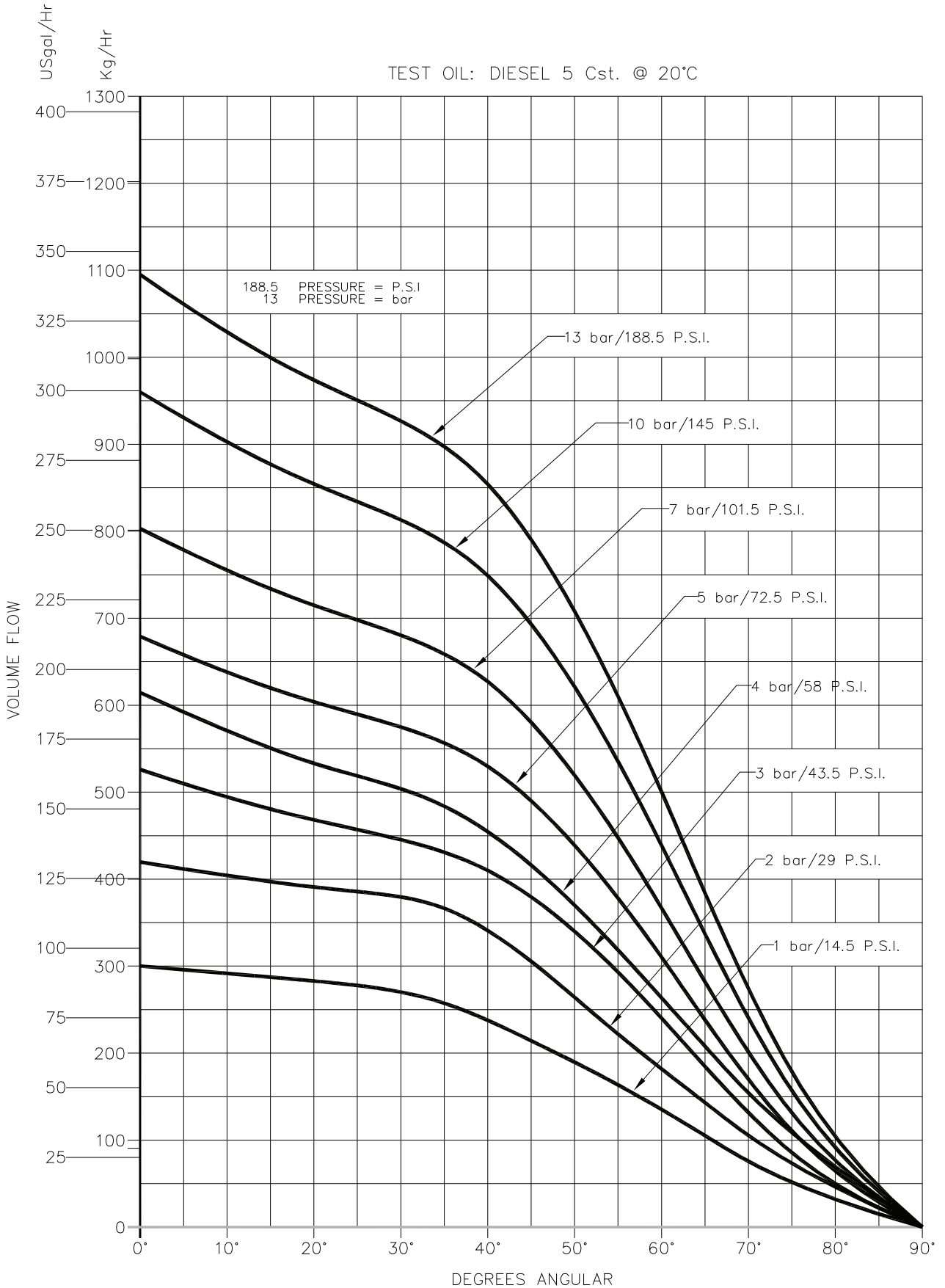
(OVM34L18 - Metering/ Simplex)



1 Fuel Control Valves

Type 5: OVS35019 - Spillback/ Bypass

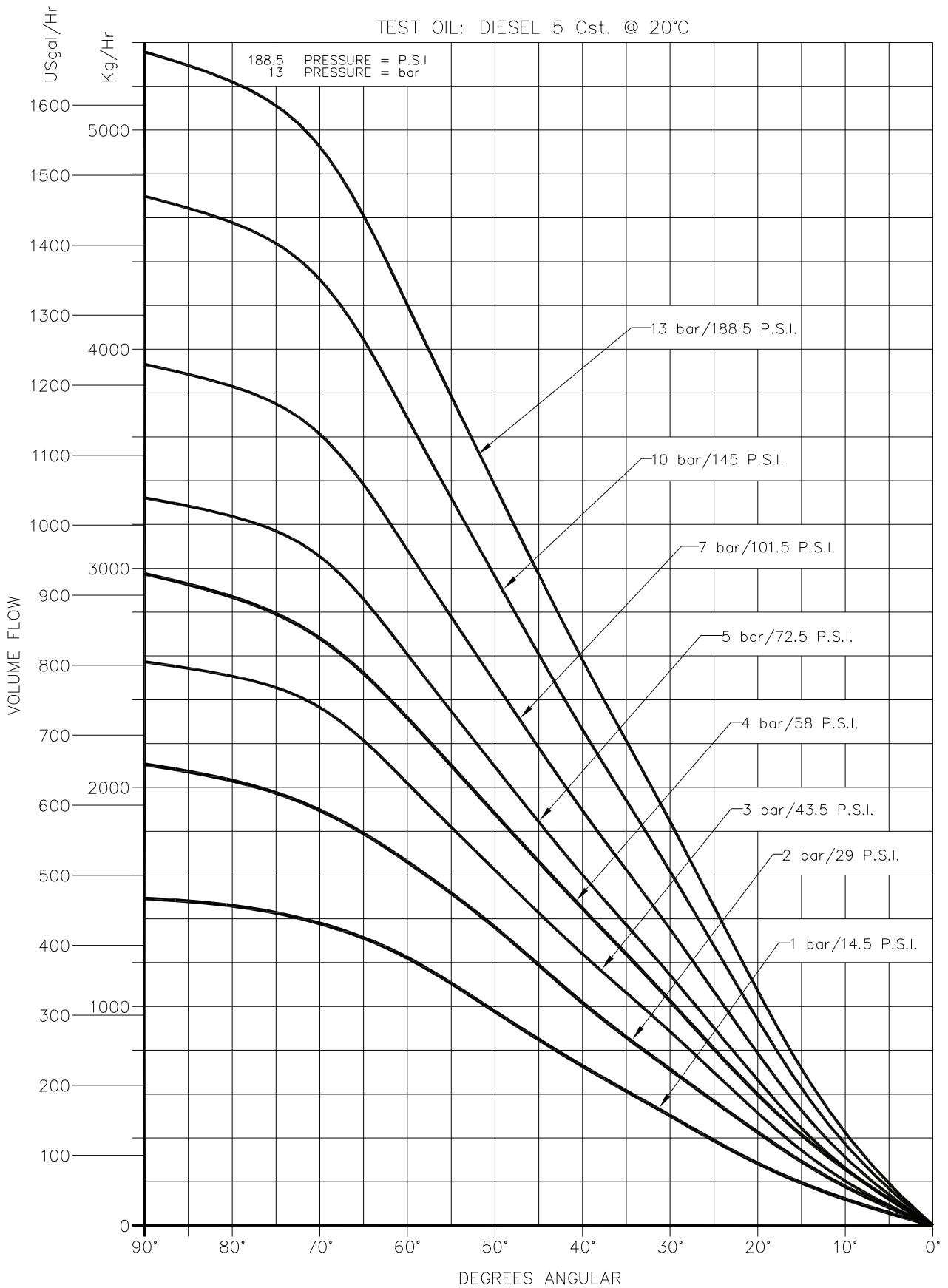
(OVM35019 - Metering/ Simplex)



1 Fuel Control Valves

Type 3: OVM33L17 - Metering/ Simplex

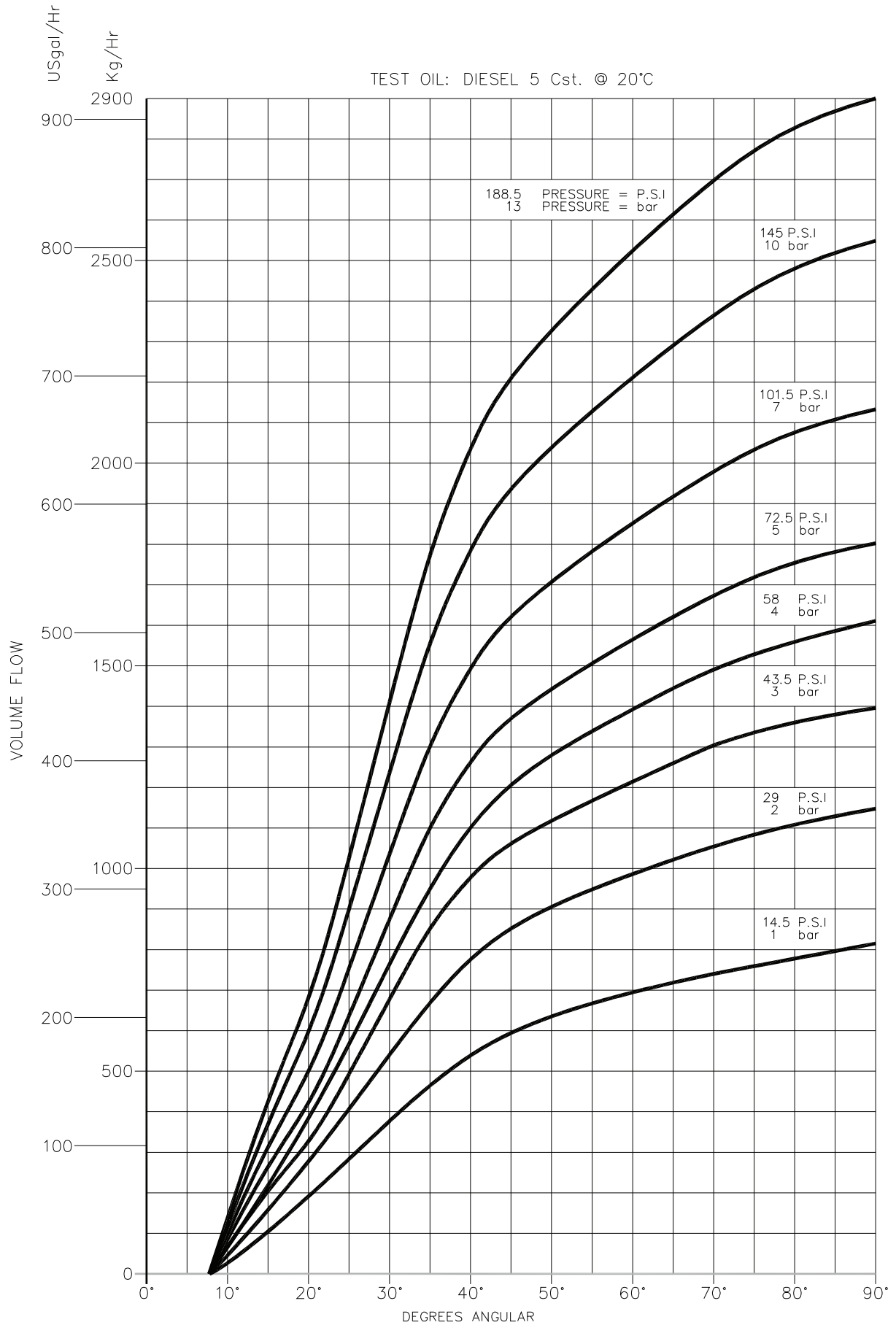
(OVS33L17 - Spillback/ Bypass)



1 Fuel Control Valves

Type 6: OVM36020 - Metering/ Simplex

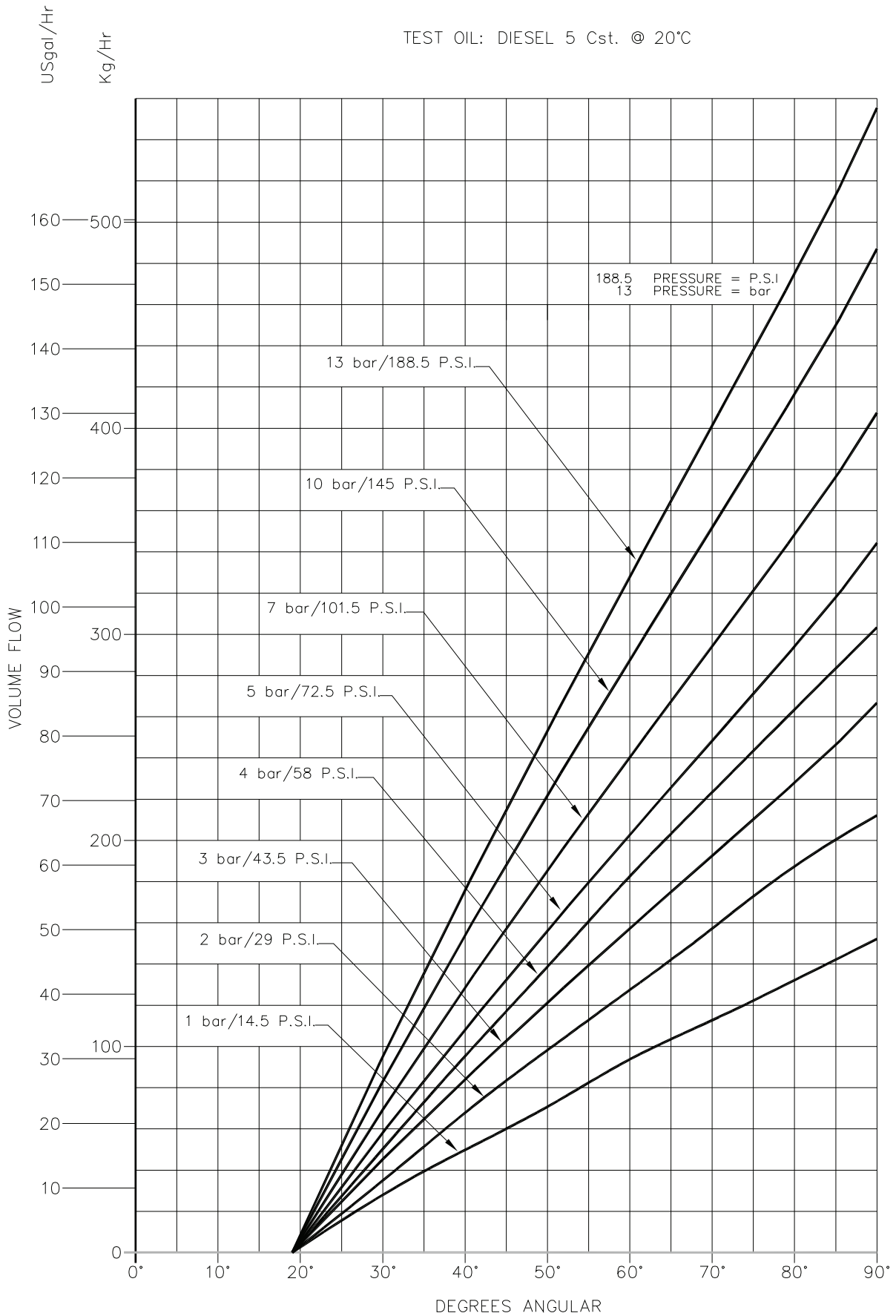
(OVS36020 - Spillback/ Bypass)



1 Fuel Control Valves

Type 8: OVM38022 - Metering/ Simplex

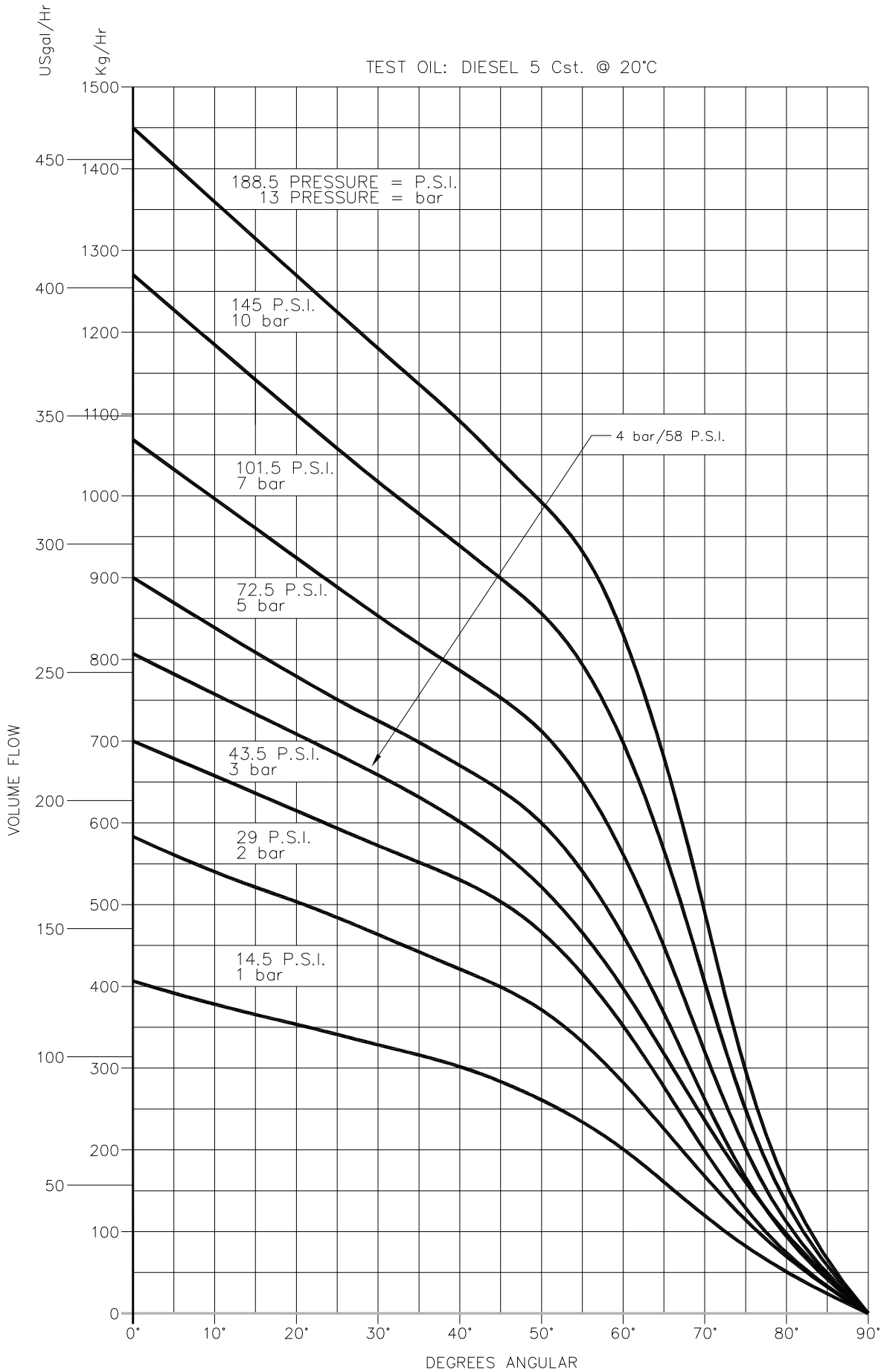
(OVS38022 - Spillback/ Bypass)



1 Fuel Control Valves

Type 9: OVS39023 - Spillback/ Bypass

(OVM39023 - Metering/ Simplex)



1.2 Oil Valves

All of the Autoflame oil valves (types 1-9) can be supplied as spillback/bypass or metering/simplex. There are many different oil valves available, metering and spillback valves. Each valve has different flow characteristics. It is important to ensure the correct oil valve selection for the application, otherwise the correct input and turndown available for the burner will not be met.

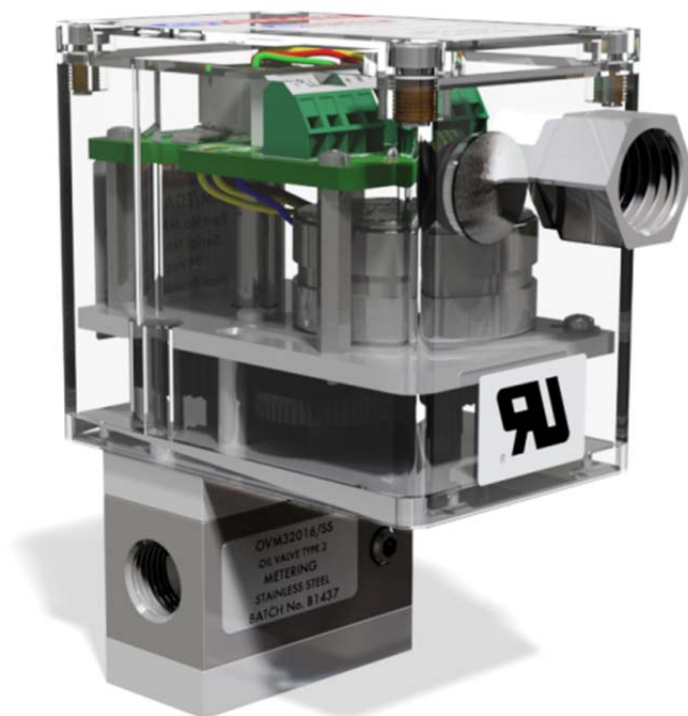
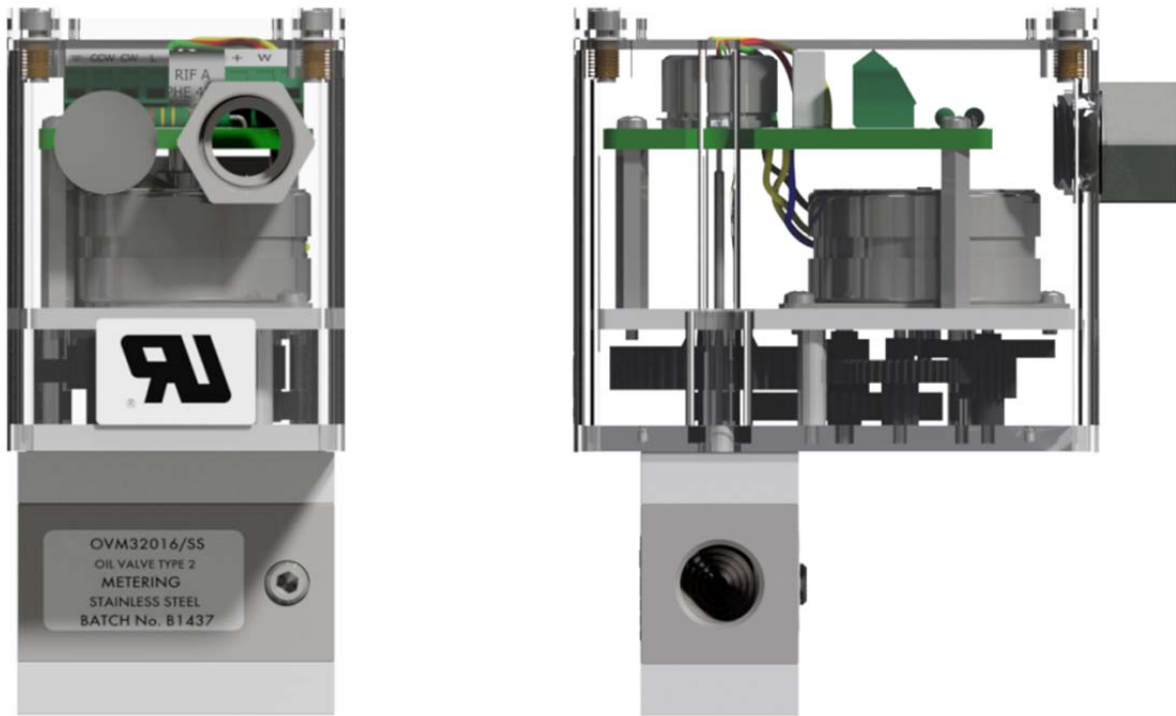
Valve Type	Pipe Thread	Spillback	Metering	Servomotor
1	1/4" BSP (NPT)	OVS31015	OVM31015	Small
2	3/8" BSP (NPT)	OVS32016	OVM32016	Small
3	3/4" BSP (NPT)	OVS33L17	OVM33L17	Large
4	3/4" BSP (NPT)	OVS34L18	OVM34L18	Large
5	3/8" BSP (NPT)	OVS35019	OVM35019	Small
6	3/8" BSP (NPT)	OVS36020	OVM36020	Small
8	3/8" BSP (NPT)	OVS38022	OVM38022	Small
9	3/8" BSP (NPT)	OVS39023	OVM39023	Small

Note: When using the oil control valve in a dual fuel application (see section 1.5), i.e. gas and oil, if the valves are to be piggy-backed, then the bottom aluminium plate of the oil valve must be removed for assembly with the gas control valve in section 1.3.

1.2.1 Small Metering/ Simplex Oil Valve

The metering valves are identifiable by the prefix OVM.

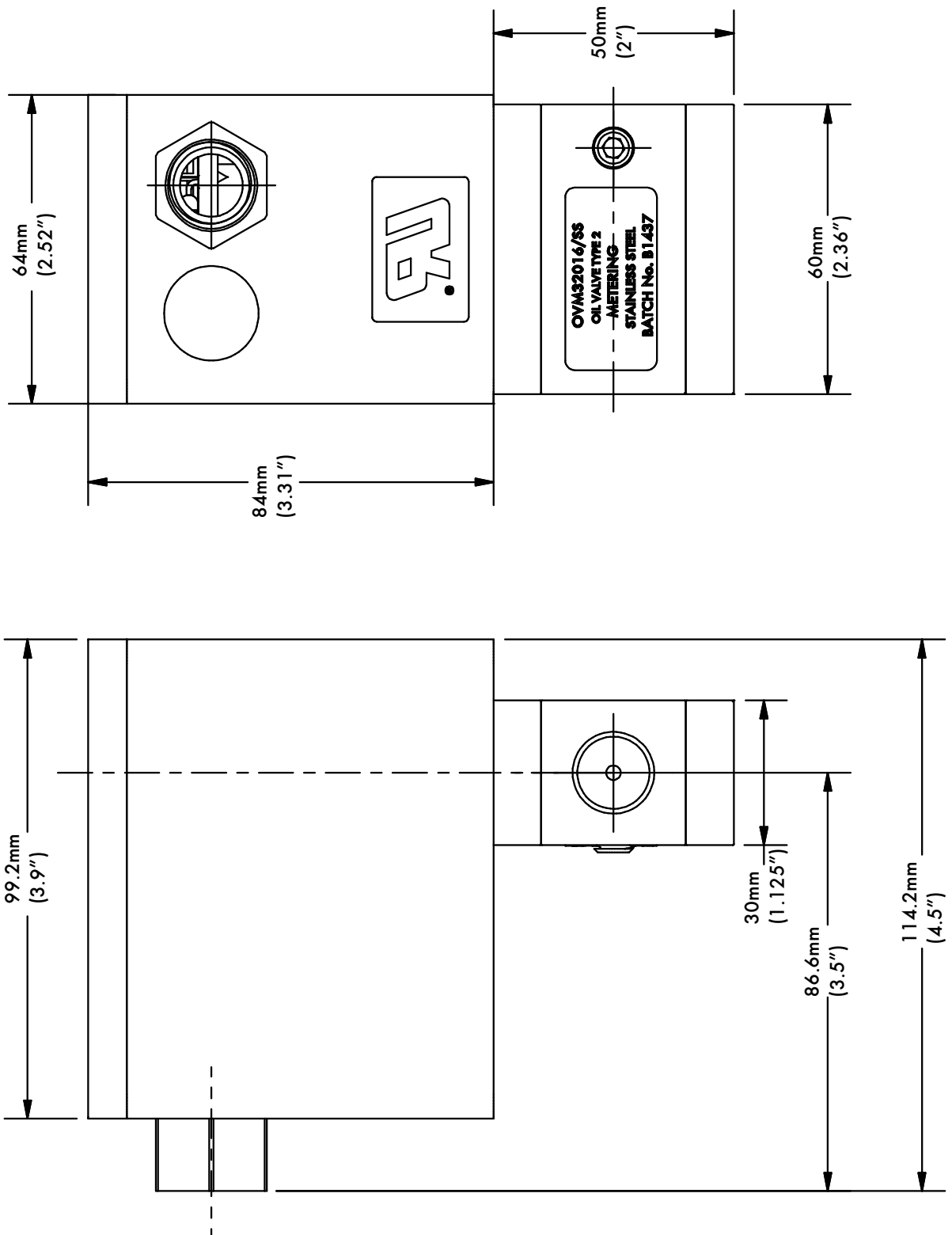
Small Metering/ Simplex Oil Valve with Small Servomotor



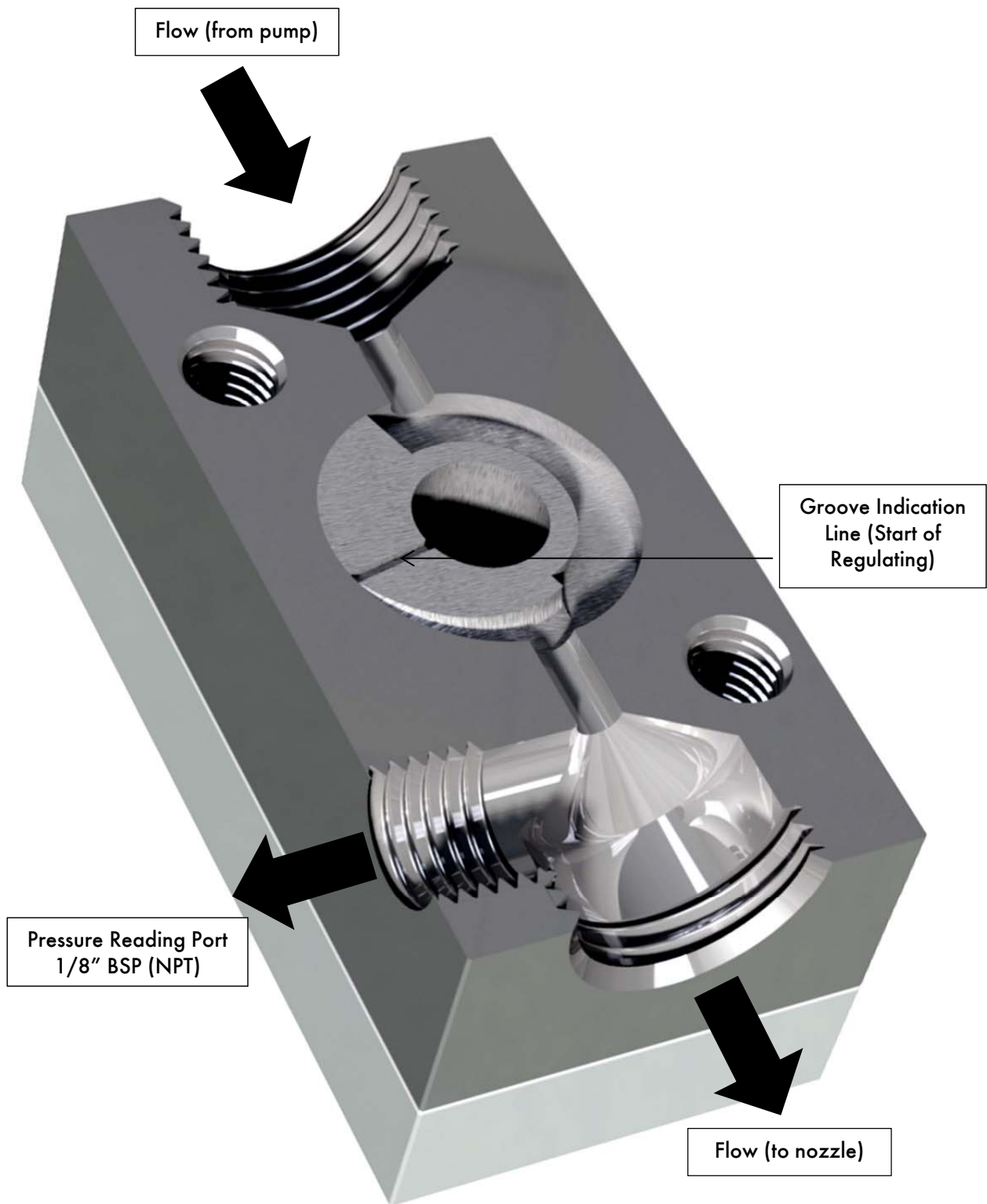
Drawing No. 9017

1 Fuel Control Valves

Small Metering/ Simplex Oil Valve with Small Servomotor - Dimensions



Small Metering/ Simplex Oil Valve - Flow



Drawing No. 9028

Small Metering/ Simplex Oil Valve - Exploded View



1.2.2 Small Spillback/Bypass Oil Valve

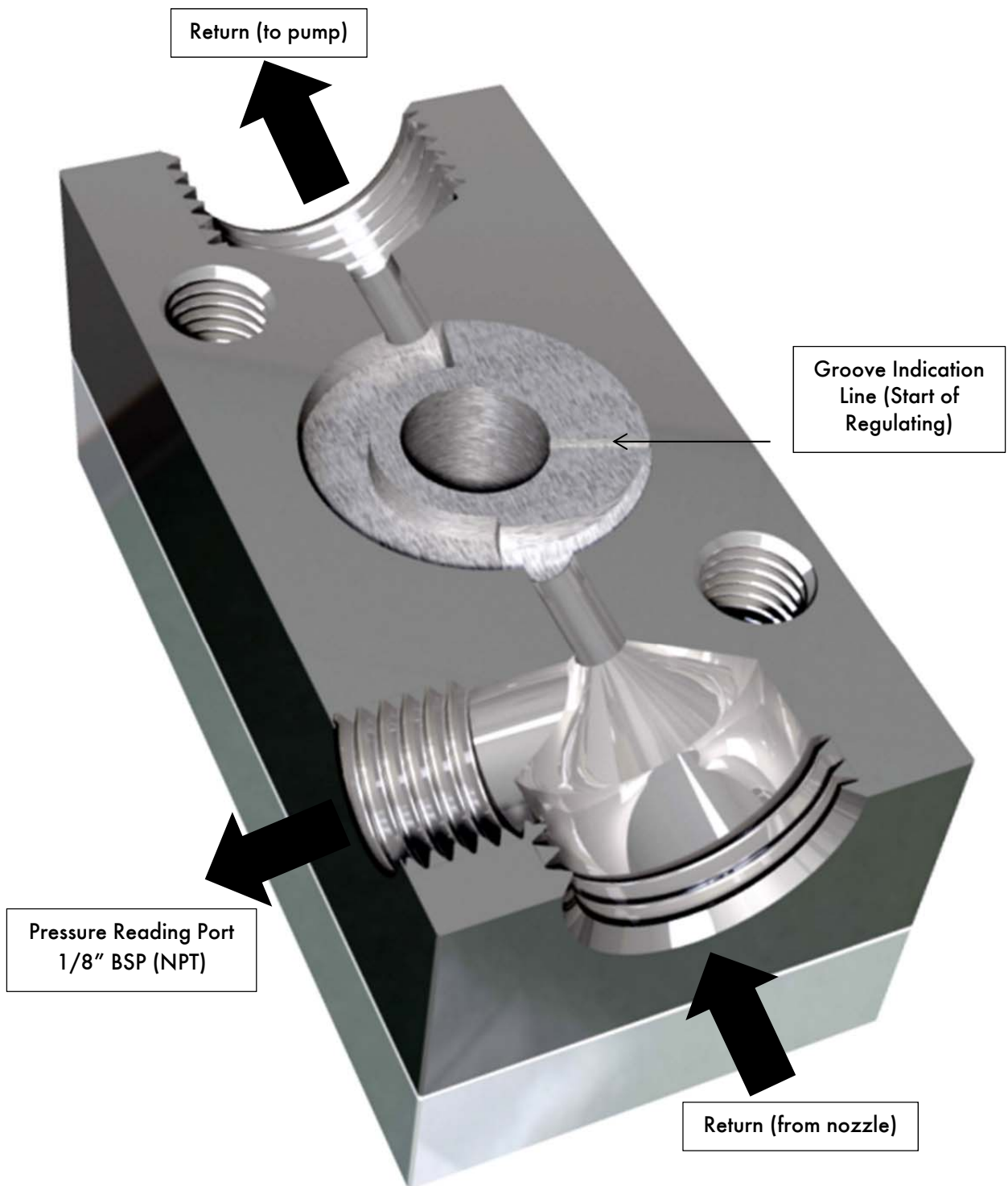
The spillback valves are identifiable by the prefix OVS.



Small Spillback Oil Valve	Height	Width	Depth
mm	50	60	30
Inches	2	2.36	1.125

Please see section 1.2.1 for the drawings shown the small spillback valve and servomotor assembled.

Small Spillback/ Bypass Valve - Flow

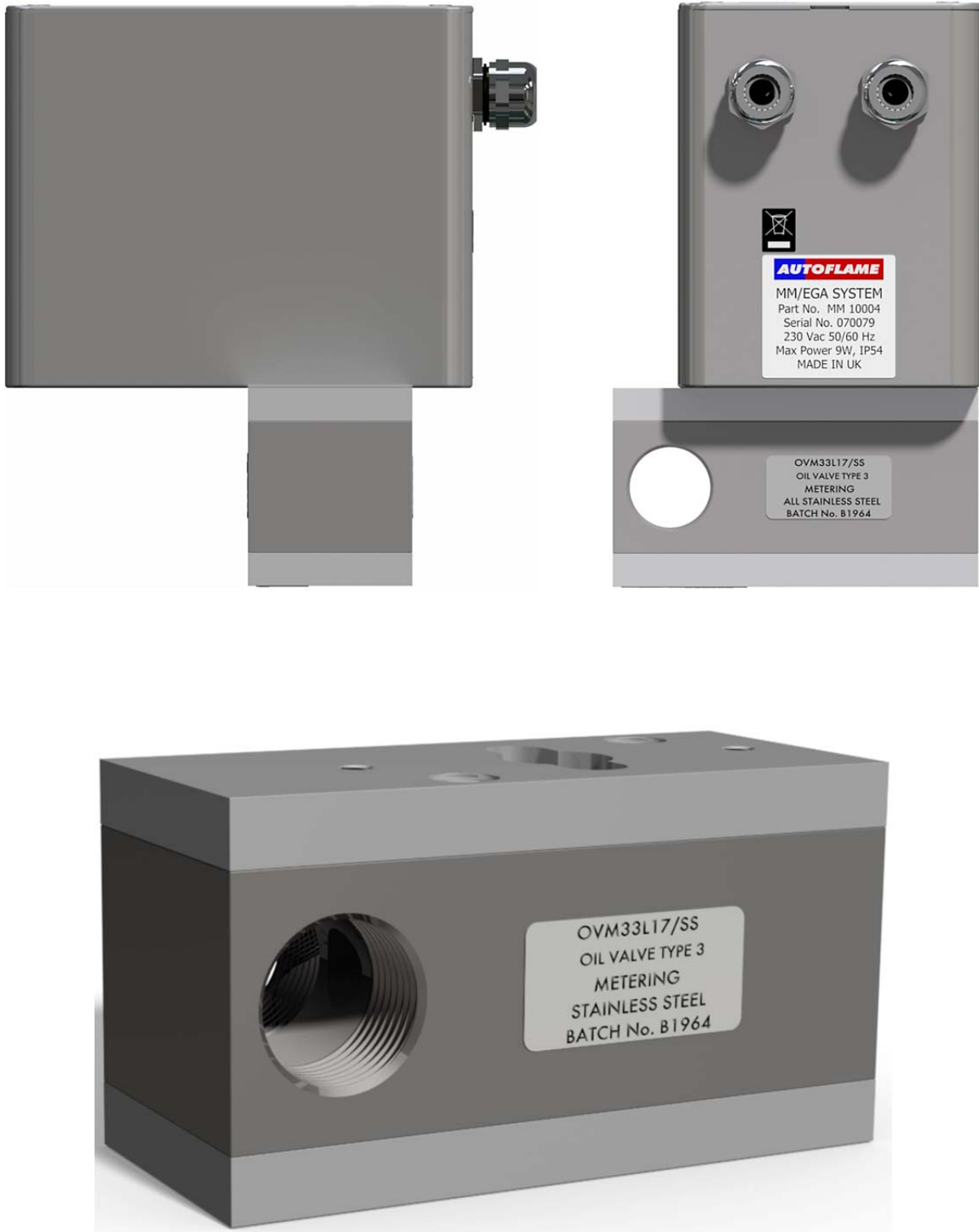


Small Spillback/ Bypass Oil Valve - Exploded View



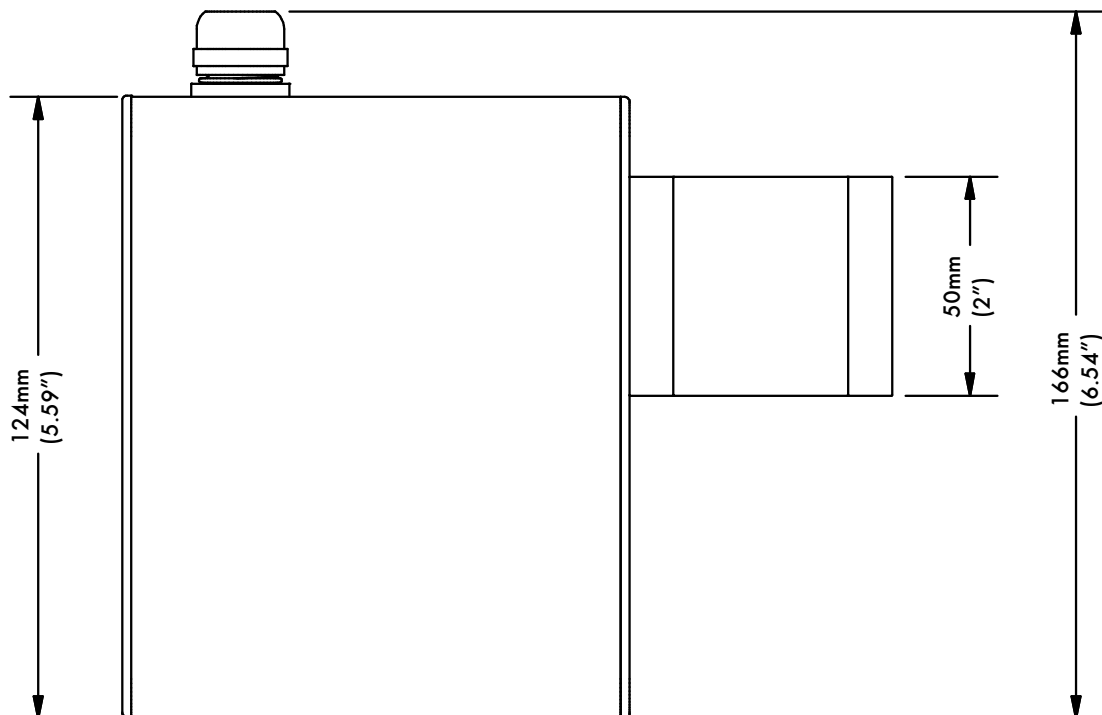
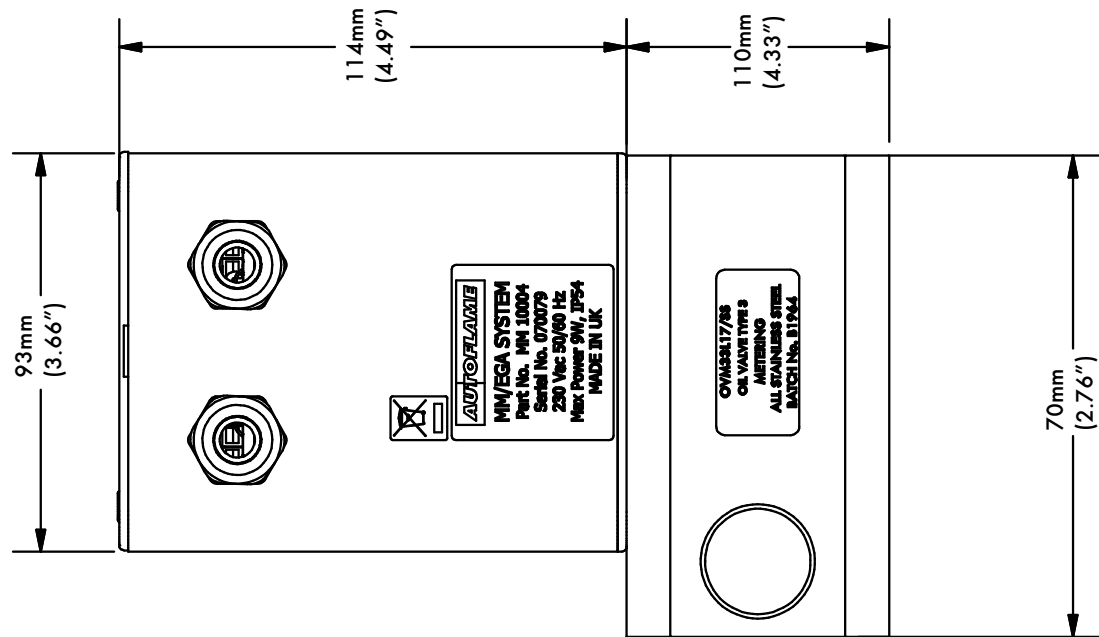
1.2.3 Large Metering/Simplex Oil Valve

Large Metering/ Simplex Oil Valve with Large Servomotor

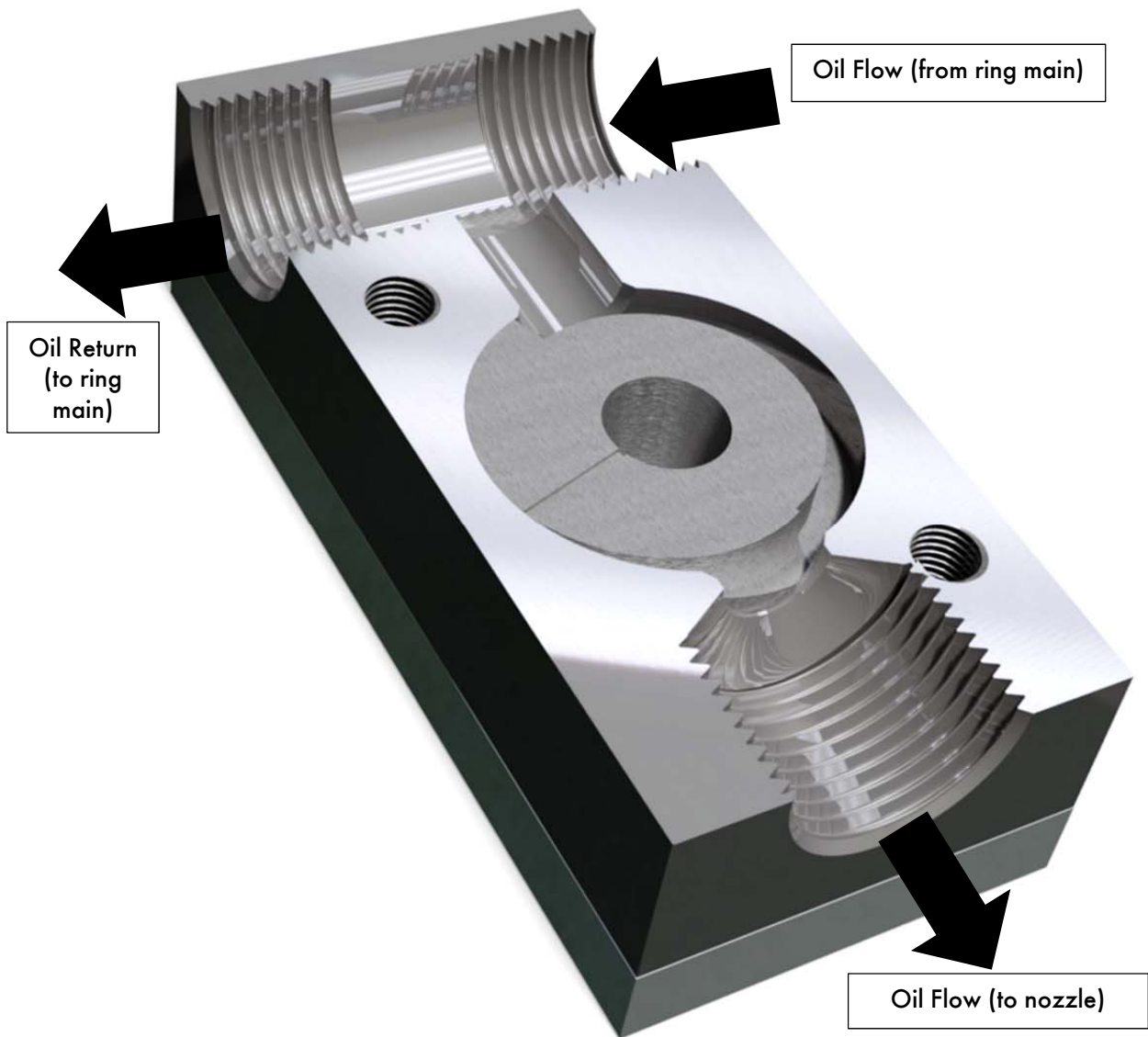


1 Fuel Control Valves

Large Metering/ Simplex Valve with Large Servomotor

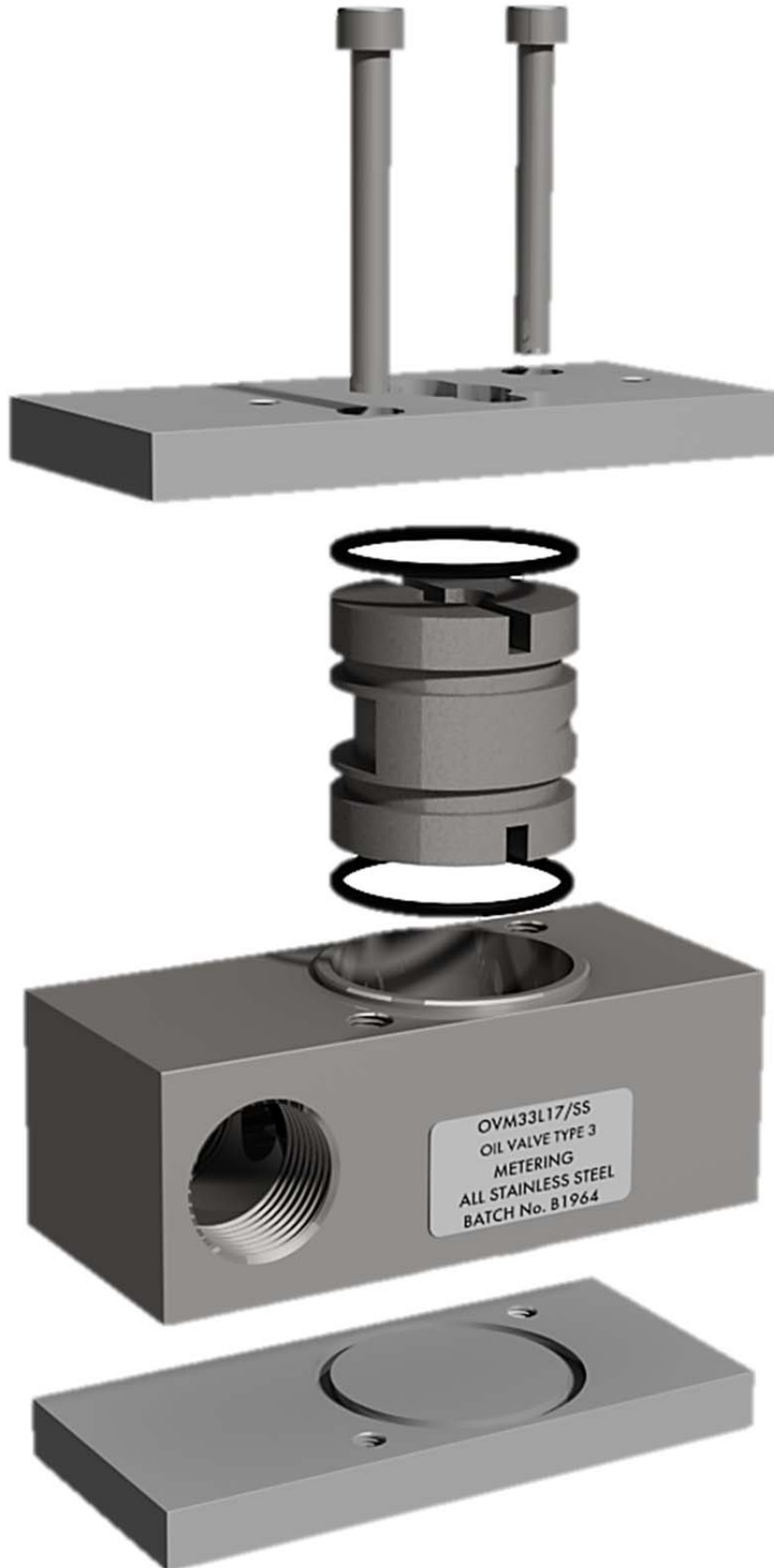


Large Metering/ Simplex Oil Valve - Flow



1 Fuel Control Valves

Large Metering/ Simplex Oil Valve - Exploded View



1.2.4 Large Spillback/ Bypass Oil Valve

Large Spillback/ Bypass Oil Valve

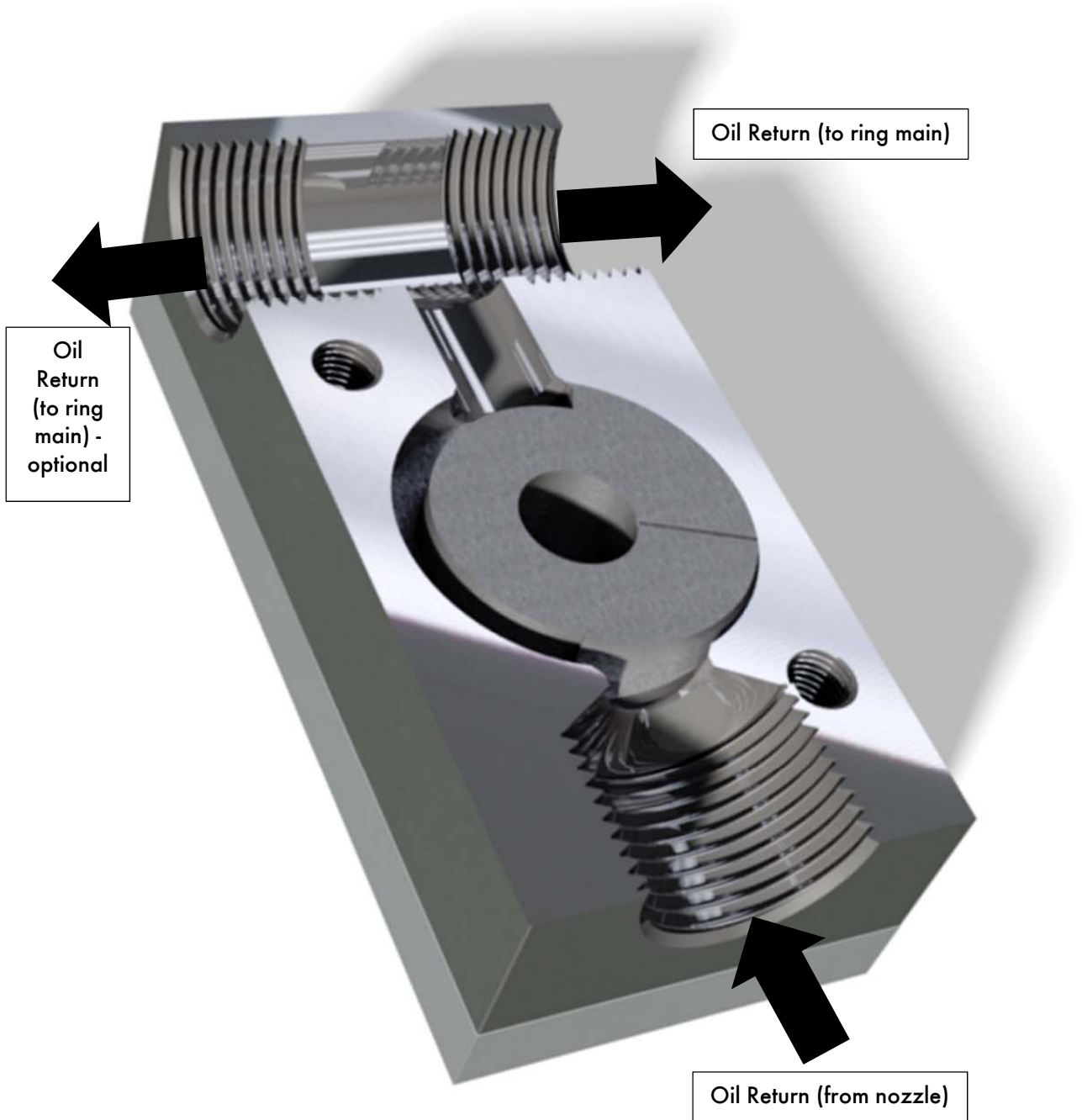


Large Spillback Oil Valve	Height	Width	Depth
mm	50	60	30
Inches	2	2.36	1.125

Please see section 1.2.3 for the drawings shown the large spillback valve and servomotor assembled.

1 Fuel Control Valves

Large Spillback/ Bypass Oil Valve - Flow



Drawing No. 9031

03.09.2015

Valves and Servomotors

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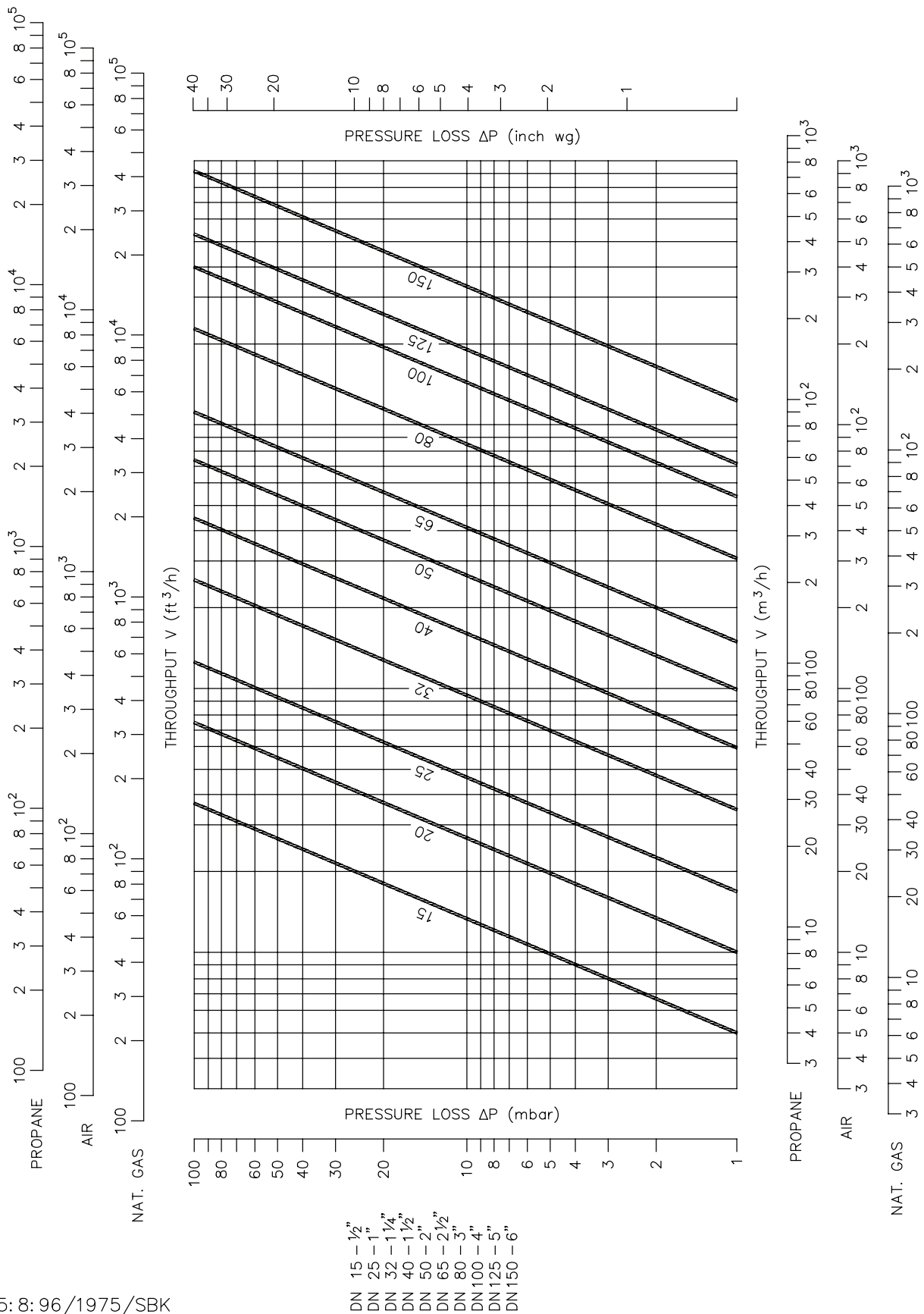
1 Fuel Control Valves

Large Spillback/ Bypass Valve - Exploded View



1.3 Gas Valve Sizing

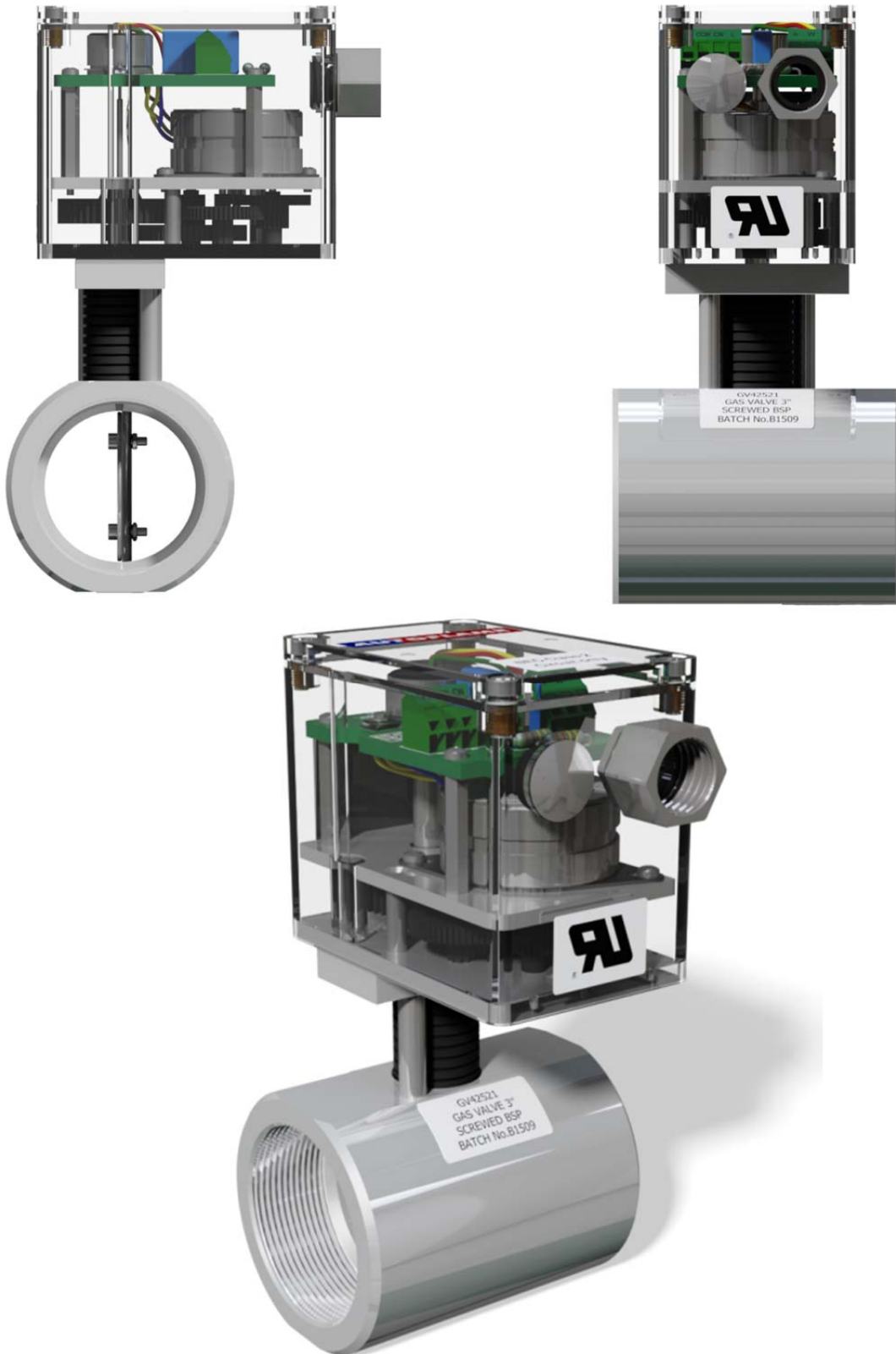
1.3.1 Autoflame Butterfly Valve Flow Data



5:8:96/1975/SBK

1.4 Gas Valves

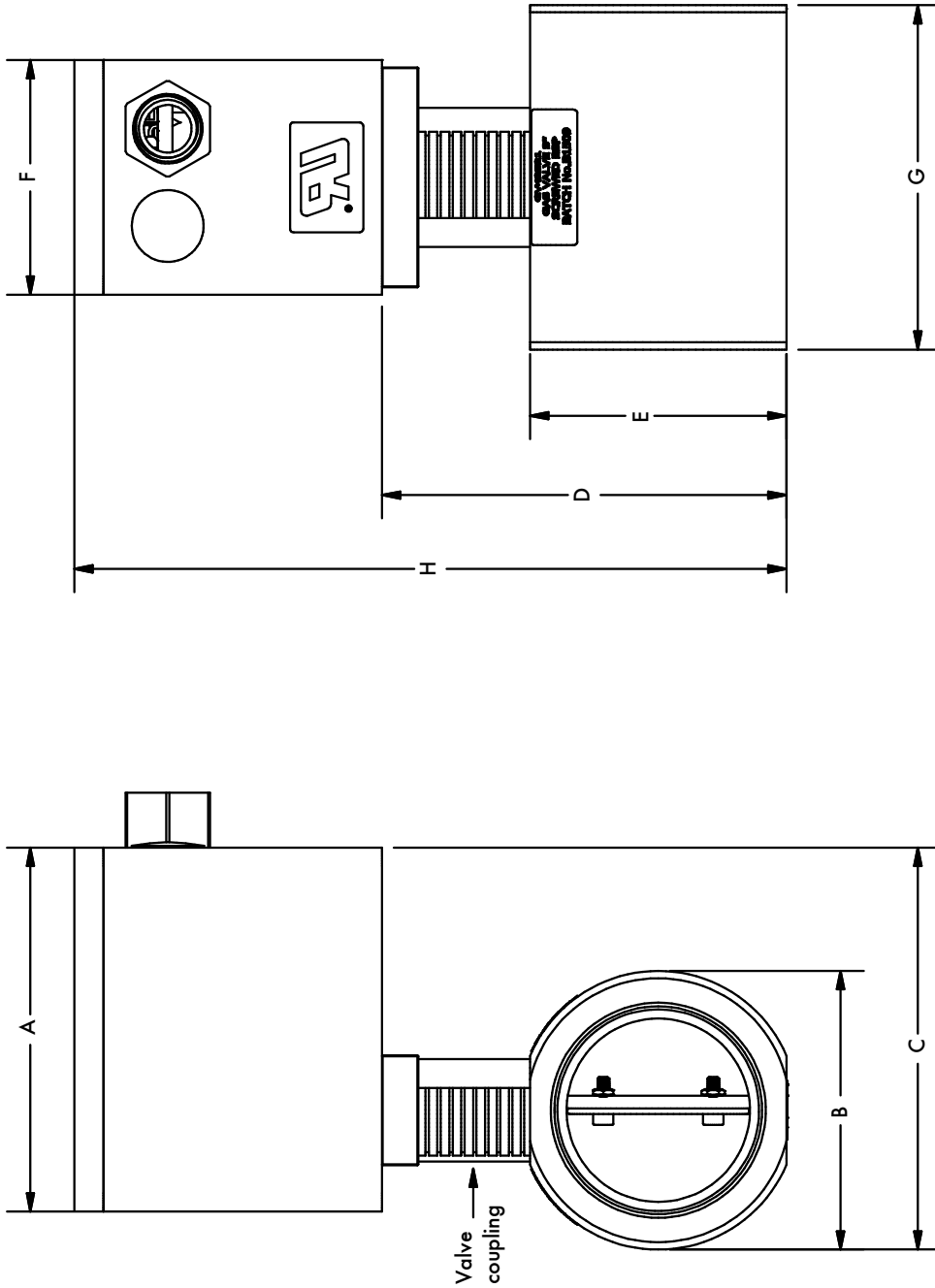
1.4.1 Threaded Gas Valve with Small Servomotor



Drawing No. 9015

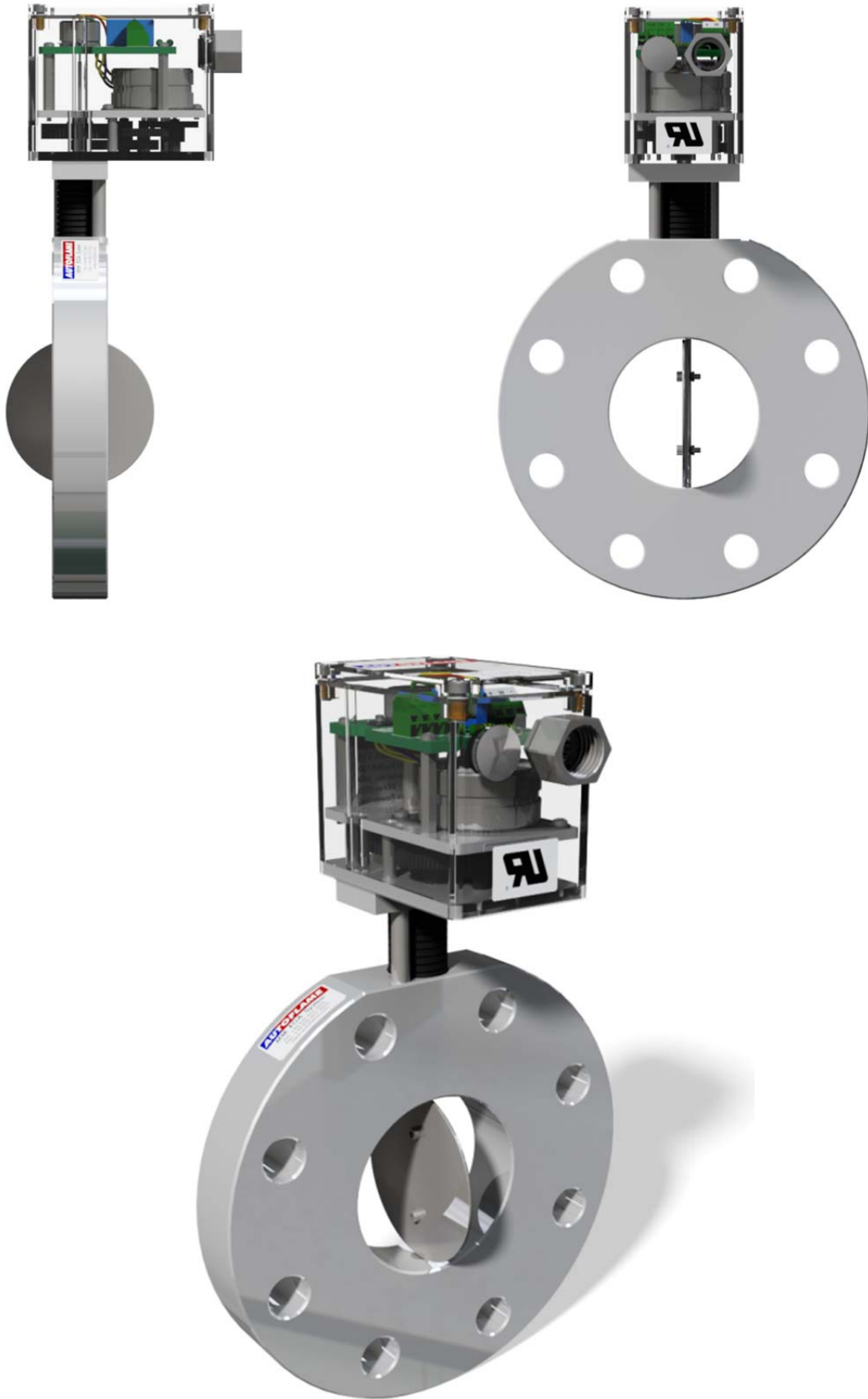
1 Fuel Control Valves

Threaded Gas Valve with Small Servomotor – Dimensions



PART NO.	Dimensions: mm (inches)										VALVE SIZE
	A	B	C	D	E	F	G	H			
GV42521 (U)	100 (3.9)	54 (2.125)	98.6 (3.88)	85 (3.35)	45 (1.75)	64 (2.52)	94 (3.7)	169 (6.68)	25 (1")		
GV44022 (U)	100 (3.9)	67 (2.64)	105.1 (4.14)	100 (4)	60 (2.375)	64 (2.52)	94 (3.7)	184 (7.27)	40 (1.5")		
GV45023 (U)	100 (3.9)	76 (3)	109.6 (4.31)	110 (4.375)	70 (2.75)	64 (2.52)	94 (3.7)	195 (7.66)	50 (2")		
GV46524 (U)	100 (3.9)	90 (3.5)	116.6 (4.59)	124 (5)	85 (3.35)	64 (2.52)	94 (3.7)	208 (8.25)	65 (2.5")		
GV48025 (U)	100 (3.9)	105 (4.125)	124.1 (4.88)	140 (5.5)	100 (4)	64 (2.52)	94 (3.7)	224 (8.84)	80 (3")		

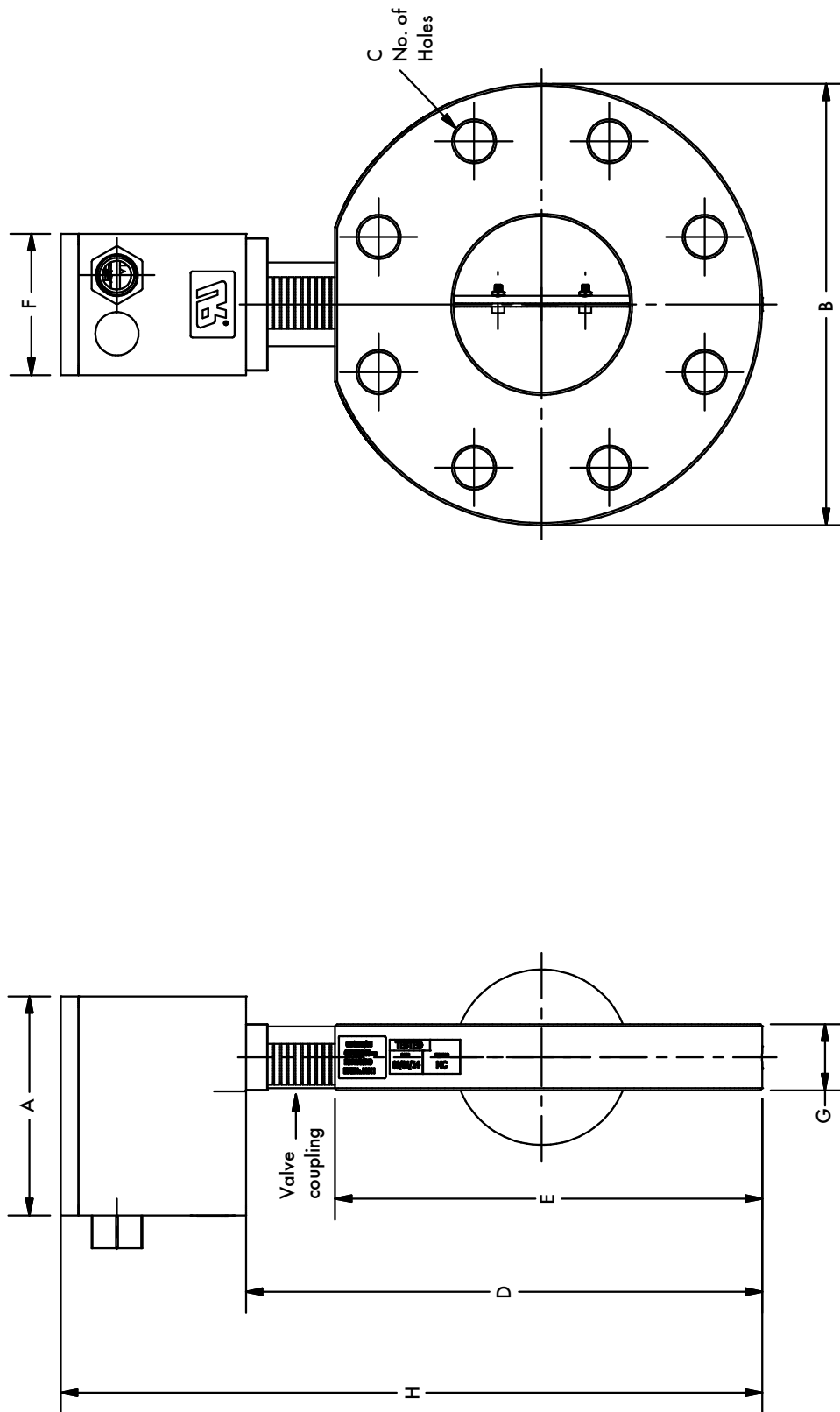
1.4.2 Flanged 30mm Thick Gas Valve with Small Servomotor



Drawing No. 9016

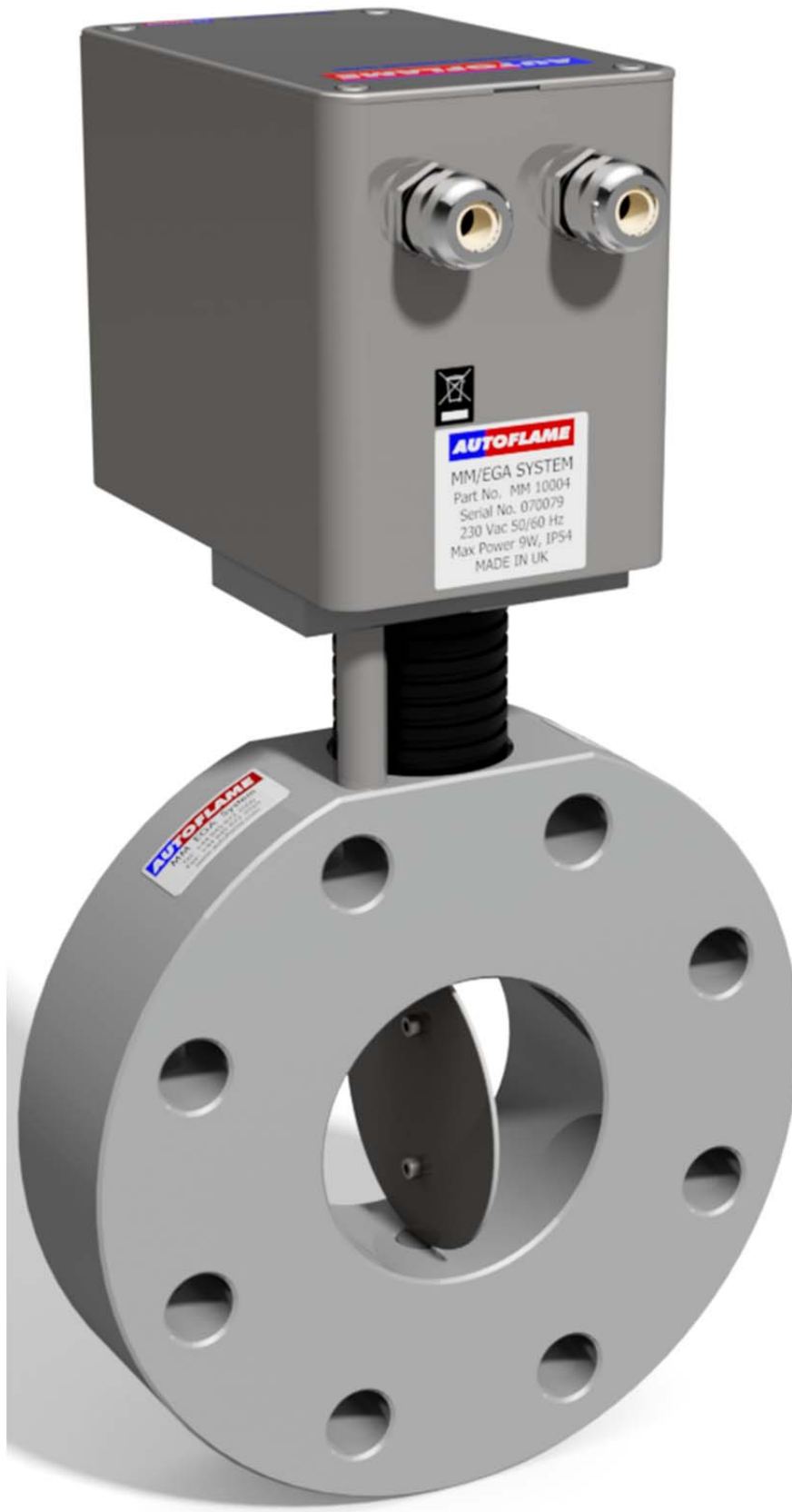
1 Fuel Control Valves

Flanged 30mm Thick Gas Valve with Small Servomotor - Dimensions



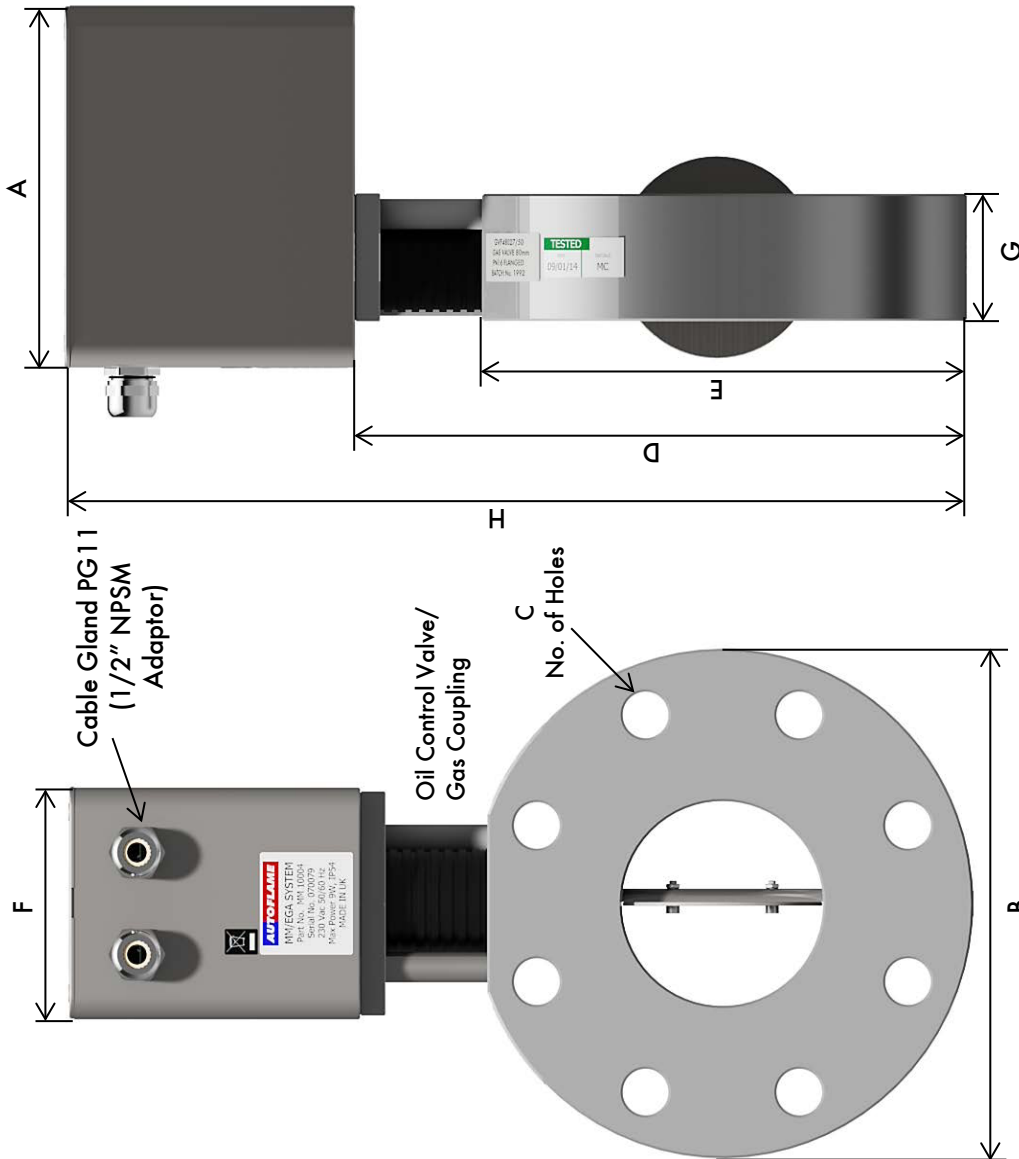
PART NO.	Dimensions: mm (inches)											VALVE SIZE
	A	B	C	D	E	F	G	H	BOLTING			
GVF45028/30 (U)	100 (3.9)	165 (6)	4	197 (8)	157 (6.25)	64 (2.5)	30 (1.125)	281 (11.25)	M16 x 110 (5/8 x 4)	50 (2")		
GVF46526/30 (U)	100 (3.9)	185 (7)	4	219 (8.6)	178 (7)	64 (2.5)	30 (1.125)	303 (11.85)	M16 x 110 (5/8 x 4)	65 (2.5")		
GVF48027/30 (U)	100 (3.9)	200 (7.5)	8	234 (9.375)	194 (7.75)	64 (2.5)	30 (1.125)	318 (12.625)	M16 x 110 (5/8 x 4)	80 (3")		
GVF410026/30 (U)	100 (3.9)	220 (9)	8	254 (10)	214 (8.5)	64 (2.5)	30 (1.125)	338 (13.25)	M16 x 110 (5/8 x 4)	100 (4")		
GVF12527/30 (U)	100 (3.9)	250 (10)	8	285 (11)	245 (9.75)	64 (2.5)	30 (1.125)	364 (14.25)	M16 x 110 (5/8 x 4)	125 (5")		
GVF415028/30 (U)	100 (3.9)	285 (11)	8	321 (12.5)	281 (11)	64 (2.5)	30 (1.125)	405 (14.25)	M16 x 110 (5/8 x 4)	150 (6")		

1.4.3 Flanged 50mm Thick Gas Valve with Large Servomotor



1 Fuel Control Valves

Flanged 50mm Thick Gas Valve with Large Servomotor - Dimensions



PART NO.	Dimensions: mm (inches)											VALVE SIZE
	A	B	C	D	E	F	G	H	BOLTING			
GVF45028/50 (U)	142 (5.59)	165 (6.5)	4	207 (8.18)	157 (6.25)	92 (3.6)	50 (2)	319 (13)	M16 X 130 (5/8 x 5)	51 (2")		
GVF46526/50 (U)	142 (5.59)	185 (7)	4	228 (9.00)	178 (7)	92 (3.6)	50 (2)	340 (13.5)	M16 X 130 (5/8 x 5)	64 (2.5")		
GVF48027/50 (U)	142 (5.59)	200 (7.5)	8	244 (9.75)	193 (7.75)	92 (3.6)	50 (2)	356 (14)	M16 X 130 (5/8 x 5)	76 (3")		
GVF410026/50 (U)	142 (5.59)	220 (9)	8	264 (10.5)	214 (8.5)	92 (3.6)	50 (2)	376 (15)	M16 X 130 (5/8 x 5)	102 (4")		
GVF12527/50 (U)	142 (5.59)	250 (10)	8	295 (11.75)	245 (9.75)	92 (3.6)	50 (2)	407 (16)	M16 X 130 (5/8 x 5)	127 (5")		
GVF415028/50 (U)	142 (5.59)	285 (11)	8	331 (13.25)	281 (11)	92 (3.6)	50 (2)	443 (17.5)	M20 X 130 (3/4 x 5)	153 (6")		
GVF420029/50 (U)	142 (5.59)	340 (13.5)	12	385 (15.5)	336 (13.5)	92 (3.6)	50 (2)	497 (19.75)	M20 X 130 (3/4 x 5)	203 (8")		

1.5 Piggy-Back Assembly

1.5.1 Threaded Gas Valve with Oil Valve

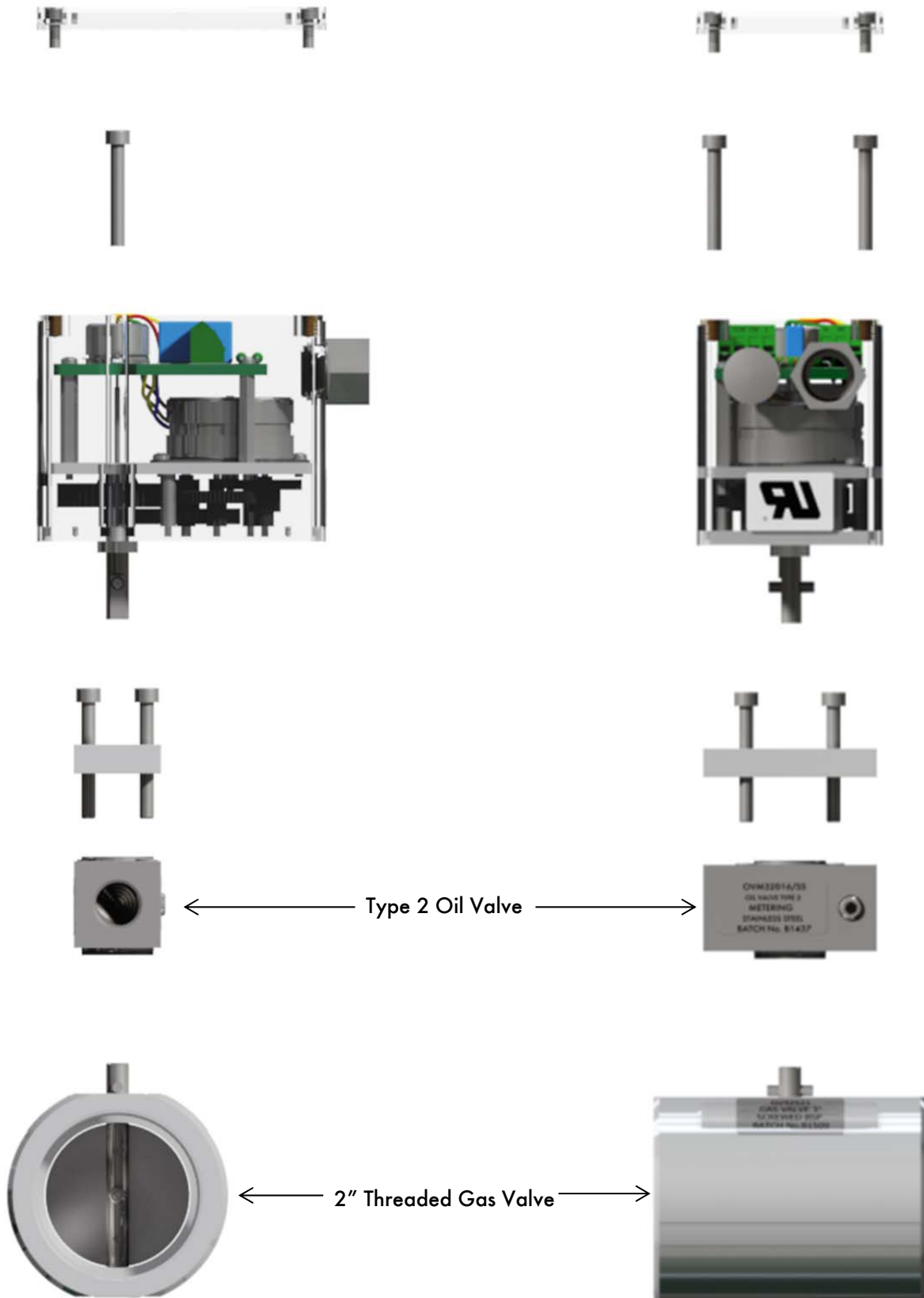
The example shown below shows the design behind utilising one servomotor for both the gas and oil valve. This shows a Type 2 oil valve with a 2" threaded gas valve using one small servomotor.



Drawing No. 9018

1 Fuel Control Valves

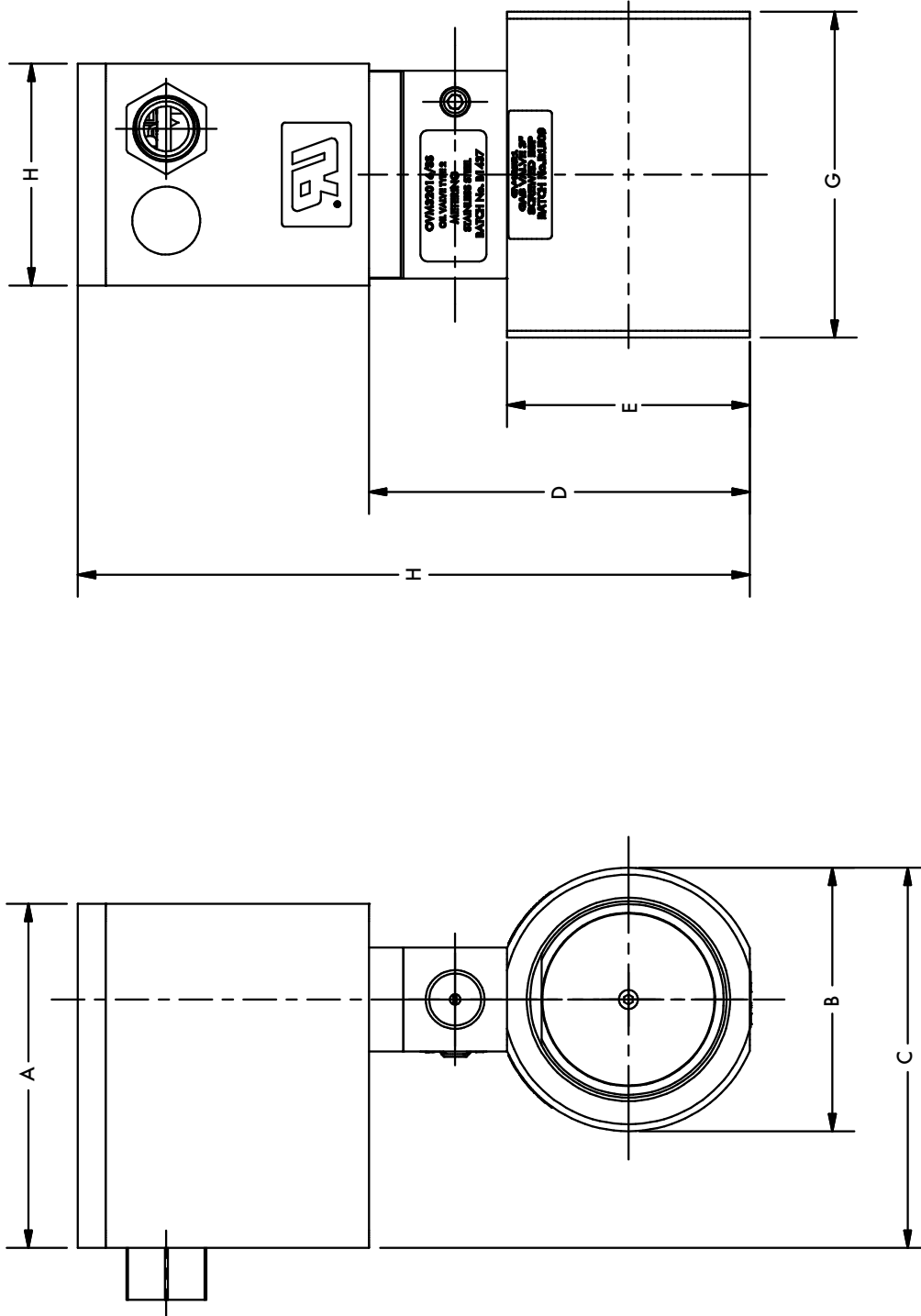
Threaded Gas Valve with Type 2 Oil Valve and Small Servomotor - Exploded View



1 Fuel Control Valves

Threaded Gas Valve with Type 2 Oil Valve and Small Servomotor – Dimensions

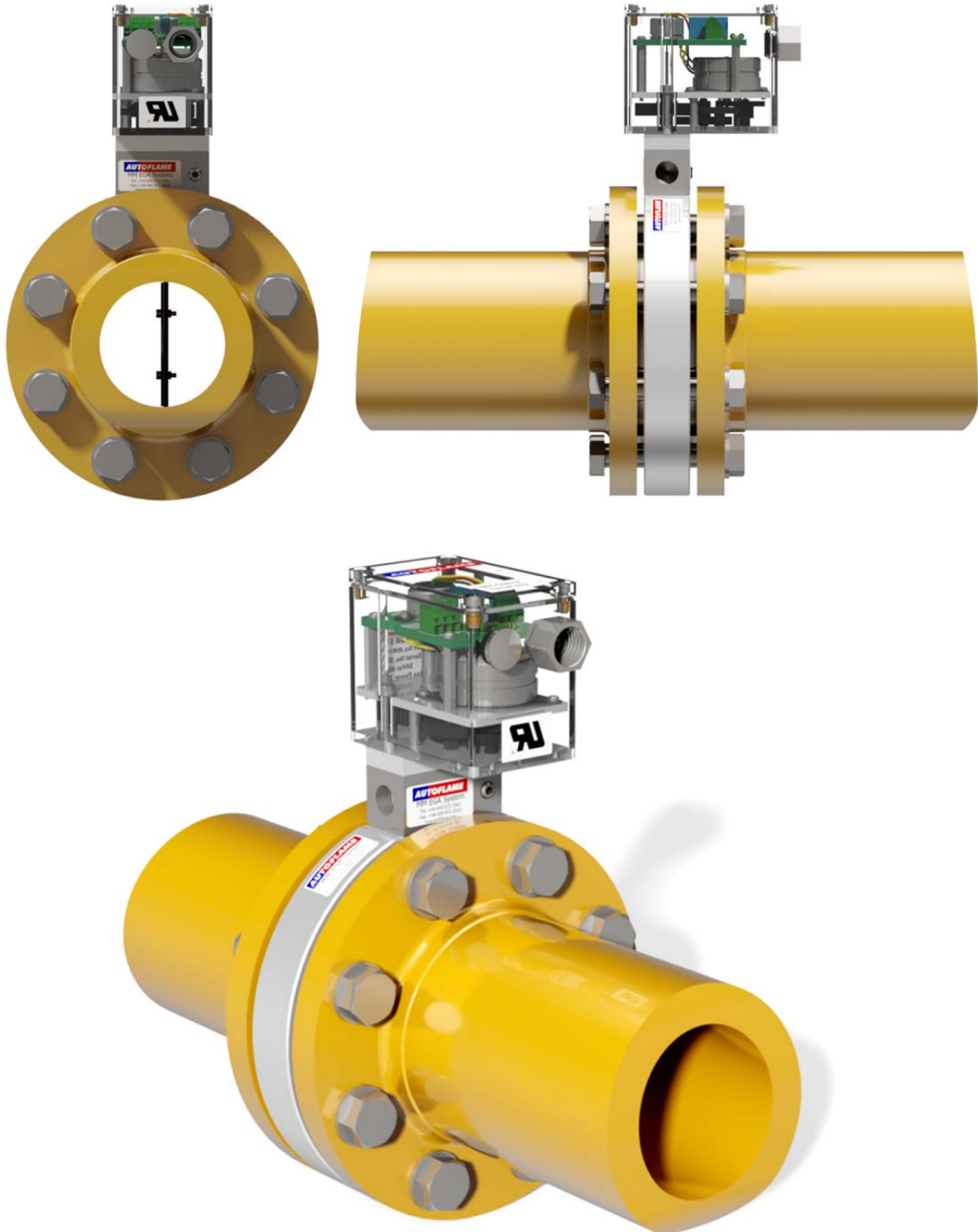
For further dimensions, please contact Autoflame.



PART NO.	Dimensions: mm (inches)										VALVE SIZE
	A	B	C	D	E	F	G	H	H	H	
GV42521 (U)	100 (3.9)	54 (2.125)	98.6 (3.88)	85 (3.35)	45 (1.75)	64 (2.52)	94 (3.7)	169 (6.68)	25 (1")		
GV44022 (U)	100 (3.9)	67 (2.64)	105.1 (4.14)	100 (4)	60 (2.375)	64 (2.52)	94 (3.7)	184 (7.27)	40 (1.5")		
GV45023 (U)	100 (3.9)	76 (3)	109.6 (4.31)	110 (4.375)	70 (2.75)	64 (2.52)	94 (3.7)	195 (7.66)	50 (2")		
GV46524 (U)	100 (3.9)	90 (3.5)	116.6 (4.59)	124 (5)	85 (3.35)	64 (2.52)	94 (3.7)	208 (8.25)	65 (2.5")		
GV48025 (U)	100 (3.9)	105 (4.125)	124.1 (4.88)	140 (5.5)	100 (4)	64 (2.52)	94 (3.7)	224 (8.84)	80 (3")		

1.5.2 Flanged Gas Valve and Oil Valve

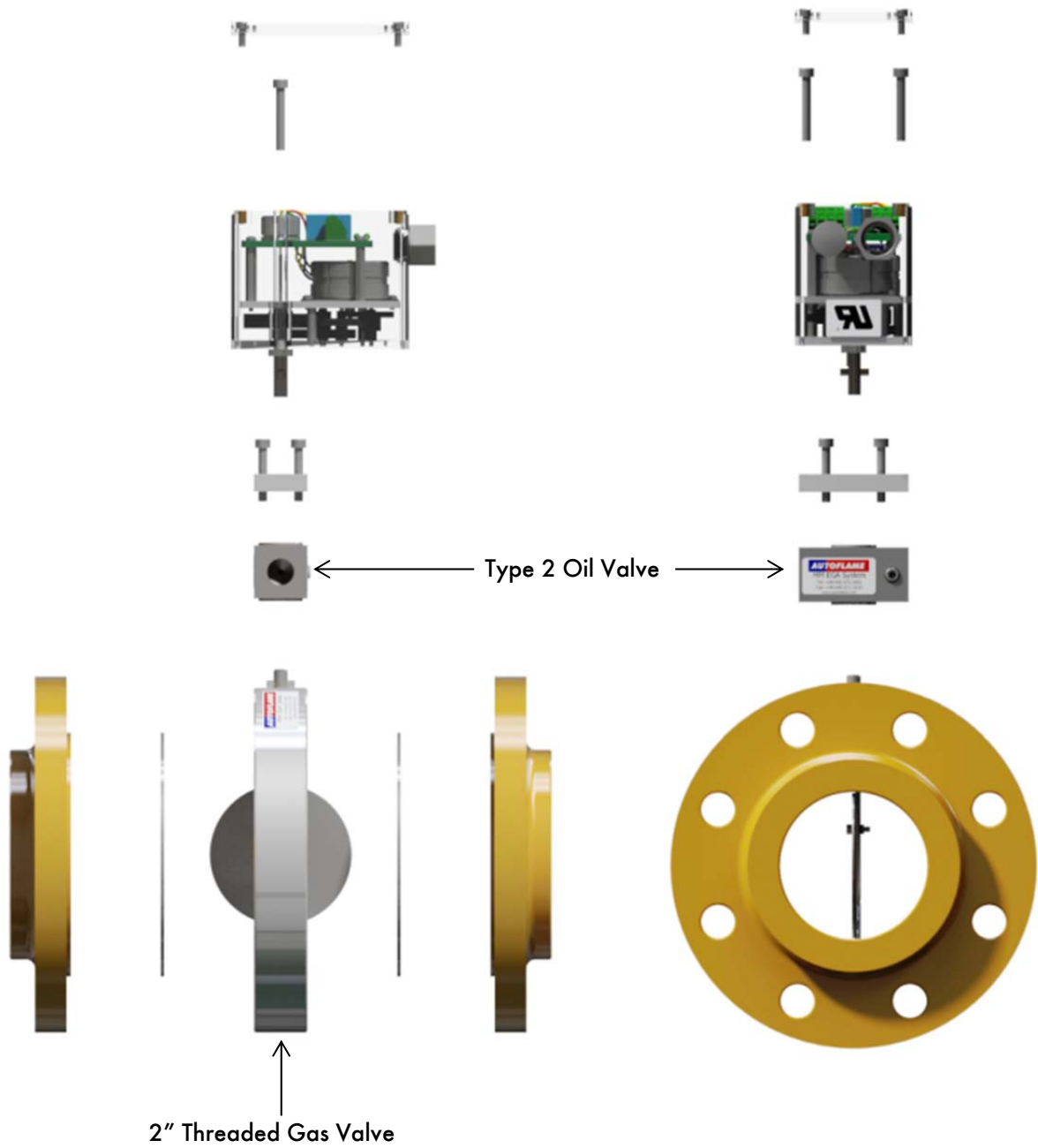
The example shown below shows the design behind utilising one servomotor for both the gas and oil valve. This shows a Type 2 oil valve with a PN16 flanged gas valve (3") using one small servomotor.



Drawing No. 9019

1 Fuel Control Valves

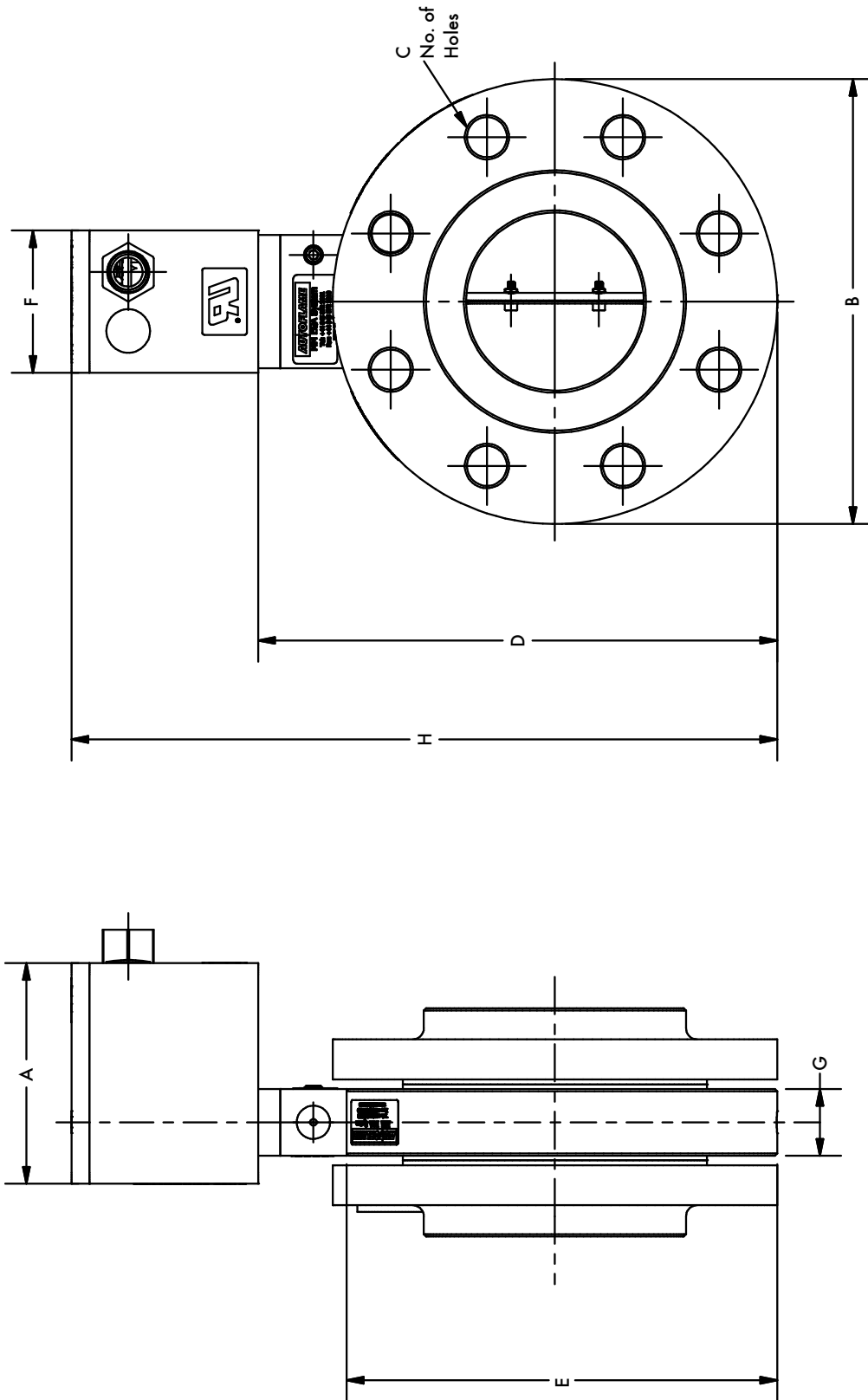
Flanged Gas Valve with Type 2 Oil Valve and Small Servomotor - Exploded View



1 Fuel Control Valves

Flanged Gas Valve with Type 2 Oil Valve and Small Servomotor – Dimensions

For further dimensions, please contact Autoflame.



Dimensions: mm (inches)												
PART NO.	A	B	C	D	E	F	G	H	BOLTING	VALVE SIZE		
OVM31015 (OVS) – GVF45038/30 (U)	100 (3.9)	165 (6)	4	197 (8)	157 (6.25)	64 (2.5)	30 (1.125)	281 (11.25)	M16 x 110 (5/8 x 4)	50 (2")		
OVM32016 (OVS) – GVF46526/30 (U)	100 (3.9)	185 (7)	4	219 (8.5)	178 (7)	64 (2.5)	30 (1.125)	303 (11.85)	M16 x 110 (5/8 x 4)	65 (2.5")		
OVM35019 (OVS) – GVF48027/30 (U)	100 (3.9)	200 (7.5)	8	234 (9.375)	194 (7.75)	64 (2.5)	30 (1.125)	318 (12.625)	M16 x 110 (5/8 x 4)	80 (3")		
OVM36020 (OVS) – GVF410026/30 (U)	100 (3.9)	220 (9)	8	254 (10)	214 (8.5)	64 (2.5)	30 (1.125)	338 (13.25)	M16 x 110 (5/8 x 4)	100 (4")		
OVM38022 (OVS) – GVF412527/30 (U)	100 (3.9)	250 (10)	8	285 (11)	245 (9.75)	64 (2.5)	30 (1.125)	364 (14.25)	M16 x 110 (5/8 x 4)	125 (5")		
OVM39023 (OVS) – GVF415028/30 (U)	100 (3.9)	285 (11)	8	321 (12.5)	281 (11)	64 (2.5)	30 (1.125)	405 (15.75)	M20 x 110 (3/4 x 4)	150 (6")		

1.6 FGR Valves

FGR Valve with Large Servomotor



Part Number	Valve Type	Valve Size	Thickness
FGR 410026/50	PN16	100mm (4")	50mm
FGR 415028/50	PN16	150mm (6")	50mm
FGR 420029/50	PN16	200mm (8")	50mm
FGR 425030/50	PN16	250mm (10")	50mm
FGR 430031/50	PN16	300mm (12")	50mm
FGR 410026/50U	ANSI 150lb	100mm (4")	50mm
FGR 415028/50U	ANSI 150lb	150mm (6")	50mm
FGR 420029/50U	ANSI 150lb	200mm (8")	50mm
FGR 425030/50U	ANSI 150lb	250mm (10")	50mm
FGR 430031/50U	ANSI 150lb	300mm (12")	50mm

For dimensions of the FGR valves please contact Autoflame.

1.7 Purge and Start Position Proving

1.7.1 Mk7 M.M. Purge and Start Position Proving

In some situations it is necessary to have an additional safety check to ensure that the servomotors, fuel valves and air dampers are in the correct position for purge and start/low fire. A cam and send switch can be placed directly on the opposite end of the Autoflame gas and oil valves. One end switch proving unit (part no. MM70009PPU) is required per valve and air damper, as well as an air damper mounting kit (part no. MM70009UMK).

For new installations, the gas and oil valves should be ordered with a suffix /VA following the standard valve part number. The end proving switch unit is not included with the gas and oil valves and should be ordered separately.

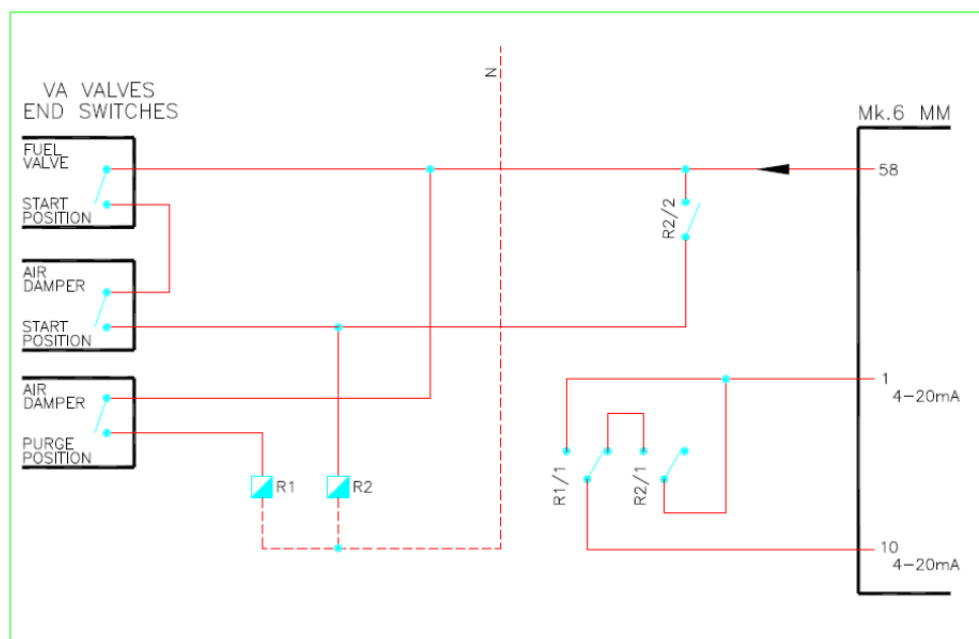
To retrofit an end switch proving unit onto an existing gas valve, the gas valve will need to be sent back to Autoflame. To retrofit an end switch proving unit onto an existing oil valve, a base mounting plate (part no. MM70009OVSM or MM70009OVLRG) and an air damper mounting kit (part no. MM70009UMK) are required as well.

Operation

- If purge position switches are not made during start-up, then the system will stay at position to purge until the switch is made.
- If the start position switches are not made, then the system will stay at position to purge until the switch is made.
- Once the system is firing, the switches will be bypassed using terminal 58 until the system stop firing and will be in operation again after recycling.

Installation

Install the switches as below and wire the end switches into the spare VSD channel terminals on the Mk7 M.M. If using more than one switch assembly, all low position switches should be wired in series and all purge position switches should also be wired in series.



Once the switch assemblies have been mounted and wired follow the standard setup procedure for commission as stated in Mk7 Manual: M.M. Installation and Commissioning Guide.

1.7.2 Mini Mk8 M.M. End Limit Switches

Options/ parameters 154, 155 and 156 have been added to set the function of terminals 80, 81 and 82, respectively. Terminal 80 is used for start position interlock, night setback input, and reduced setpoint input. Terminal 81 is used for purge interlock and low flame hold input. Terminal 82 is used for warming stat and valve proving mains input. Proving valves (end switch) provide a secondary confirmation that a valve has reached a predefined position.

To install the End Limit Switches,

1. Mount the servomotor onto the valve and ensure the potentiometer reads the correct position on the M.M. for the "CLOSED" and "OPEN" valve positions.
2. Mount the End Switch Proving Unit (E.S.P.U.). The servomotor may have to be moved to a suitable position in order to allow the E.S.P.U. to be attached to the valve.
3. Undo the End Limit Switch holding screws.
4. Adjust the position of CAM corresponding to switches 1 (S1) and 2 (S2) by loosening the CAM screws and move to the required position.
5. Wire the ESPU according to the Valve Proving the End Limit Switch will be required to provide. See the End Limit Switch wiring diagram in Figure 1.7.2.i

Note: The use of these switches is determined by the application approval necessary. These are not required to meet UL, FM or CE.

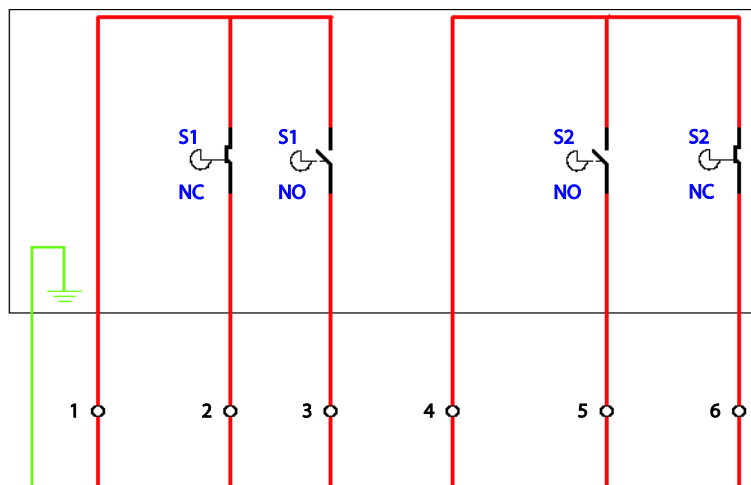


Figure 1.7.2.i End Switch Wiring Schematic

End Limit Switches are mounted on the end of bespoke valves (please contact Autoflame regarding bespoke valve manufacture) which are attached to the air and fuel valve and commissioned depending on the use of the End Limit Switches. An End Limit Switch comprises of two switches, as shown in Figure 1.7.2.i. Each comprises of an Earth and 6 connections to be wired as appropriate. The switches S1 and S2 are setup as per on site specification. These are then wired into either or both of the terminals 80, the start position interlock, and terminal 81 purge interlock.

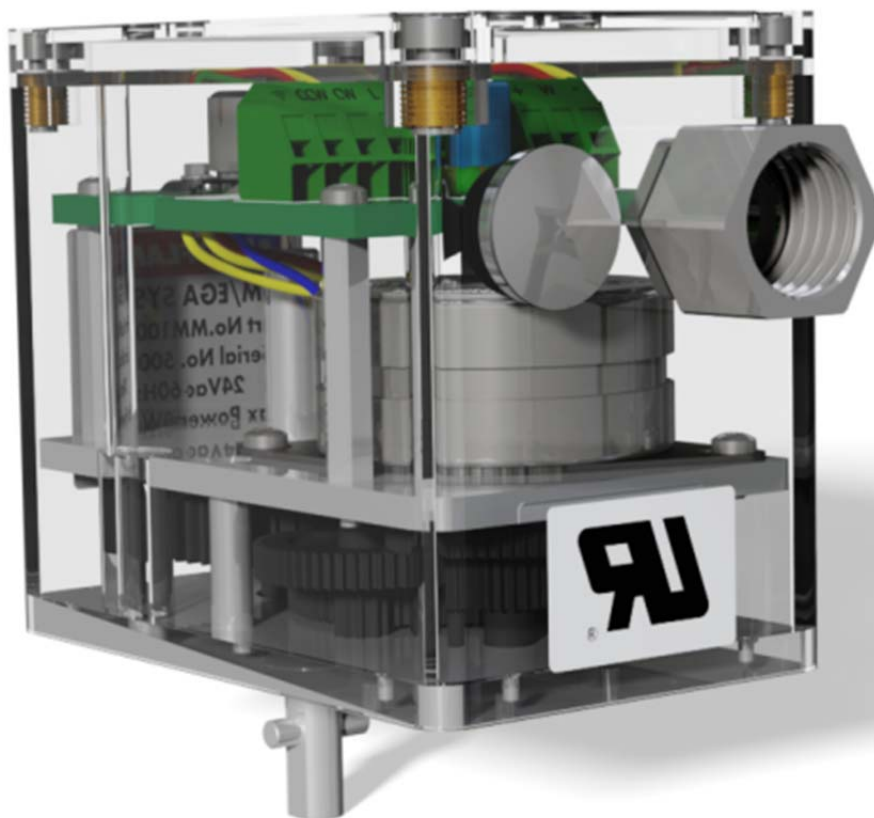
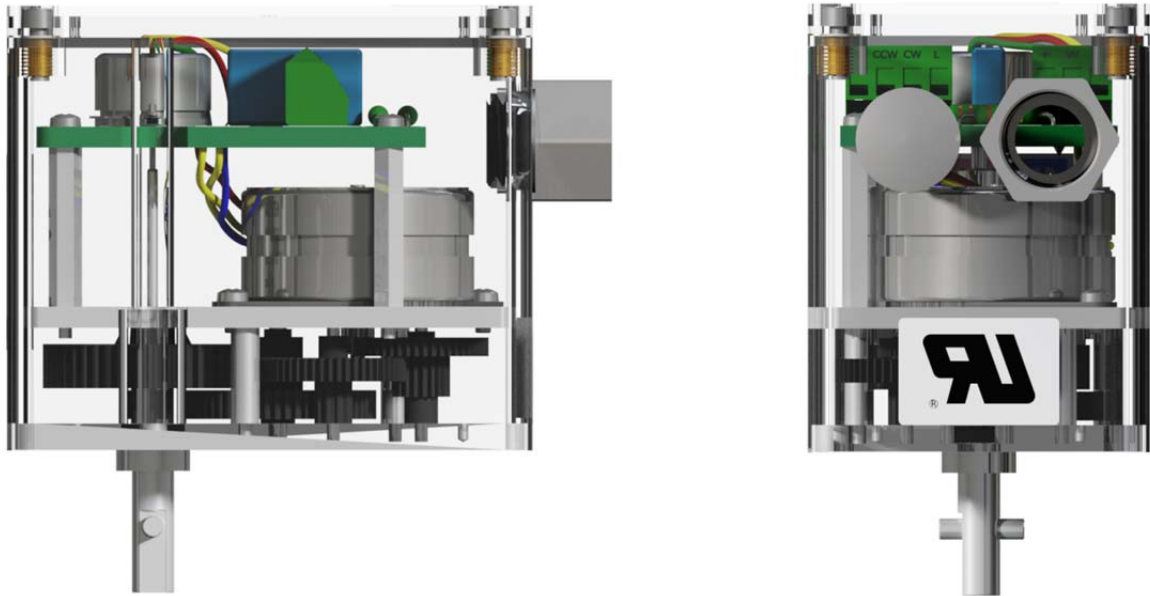
If option/ parameter 154 is set to 1, then the M.M. waits at RUN TO IGNITION until this interlock is made on terminal 80. If option/ parameter 155 is set to 1 then M.M. waits at RUN TO PURGE until this interlock is made on terminal 81.

If option/ parameter 154 is set to 2, terminal 80 is the night setback input (night setback offset must be set in option 85). If it is set to 3, terminal 80 is used for reduced setpoint input. If option/ parameter 155 is set to 2, terminal 81 is used for the low flame hold input. If option/ parameter 156 is set to 0, than terminal 82 is used for the warming stat for sequencing. If it is set to 1, terminal 82 is used for the valve proving mains input (see option/ parameter 128).

2 SERVOMOTORS

2.1 Small Servomotor

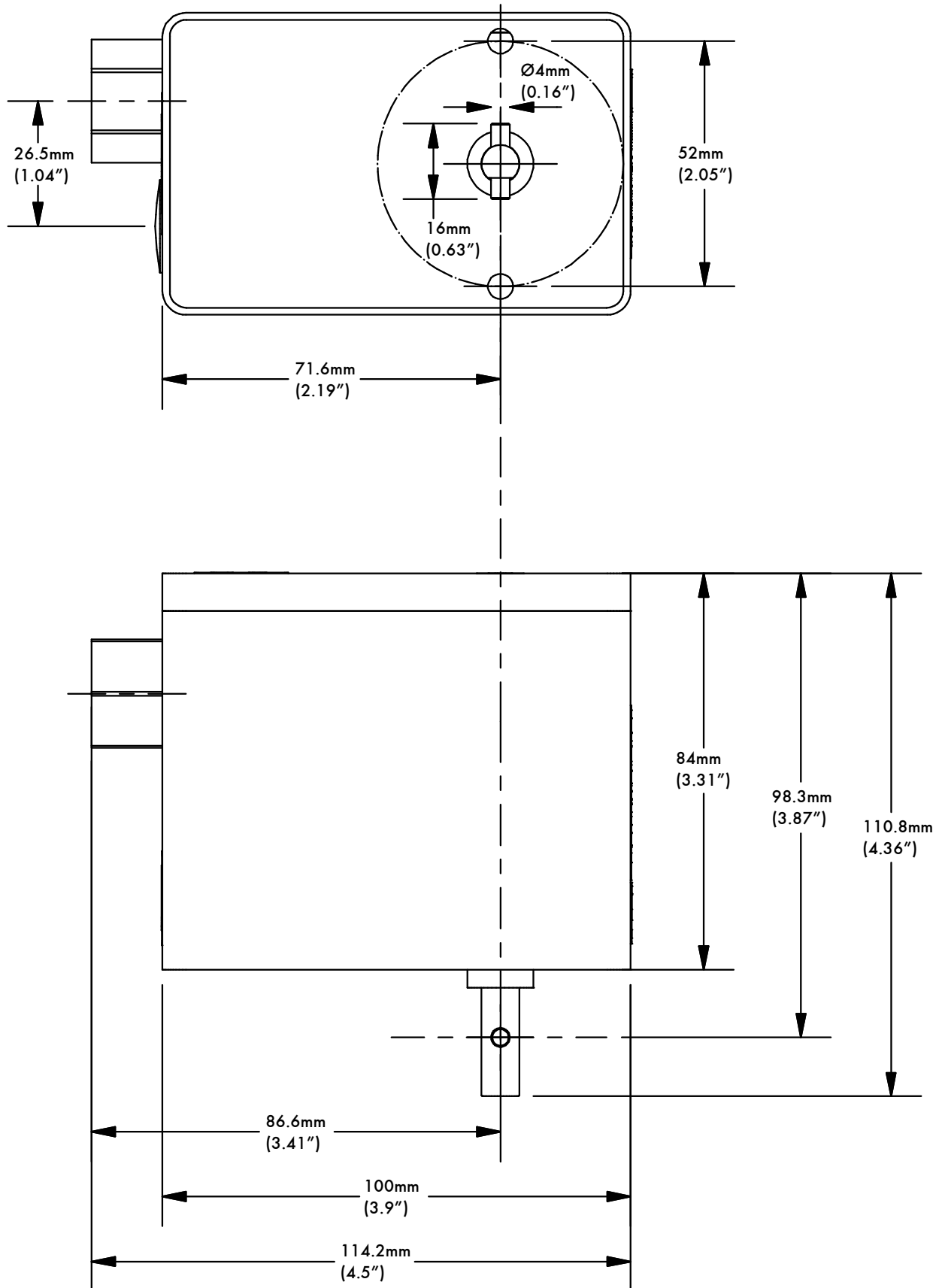
All small servomotors are supplied with PG11 cable glands, except for 24V small servomotors which are supplied with 1/2" NPSM adaptor.



Drawing No. 9020

2 Servomotors

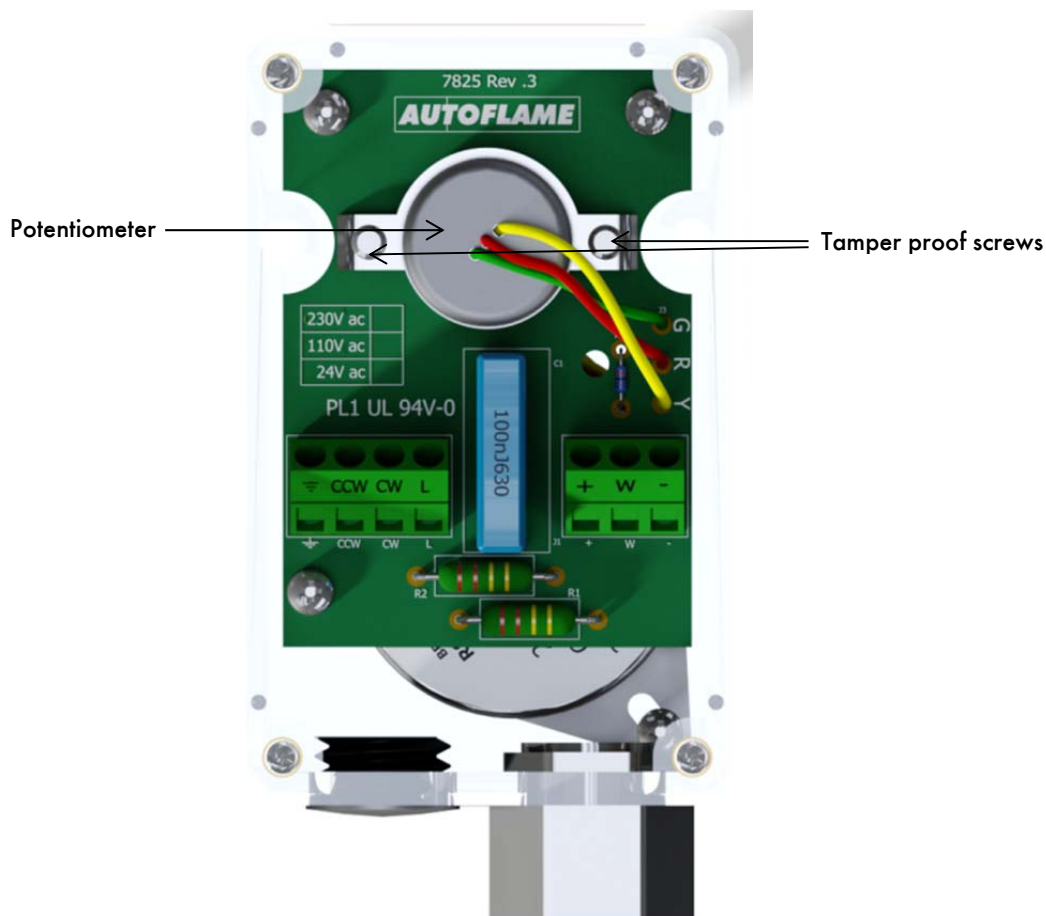
Small Servomotor - Dimensions



2 Servomotors

Servomotors must only be installed and adjusted by an Autoflame certified technical engineer.

To adjust the potentiometer, loosen the tamper proof screws using a tamper proof screwdriver available from Autoflame. Use fingers only to adjust the position of the potentiometer. After adjustment, ensure tightness, do not over tighten. Do not raise the potentiometer from the PCB.

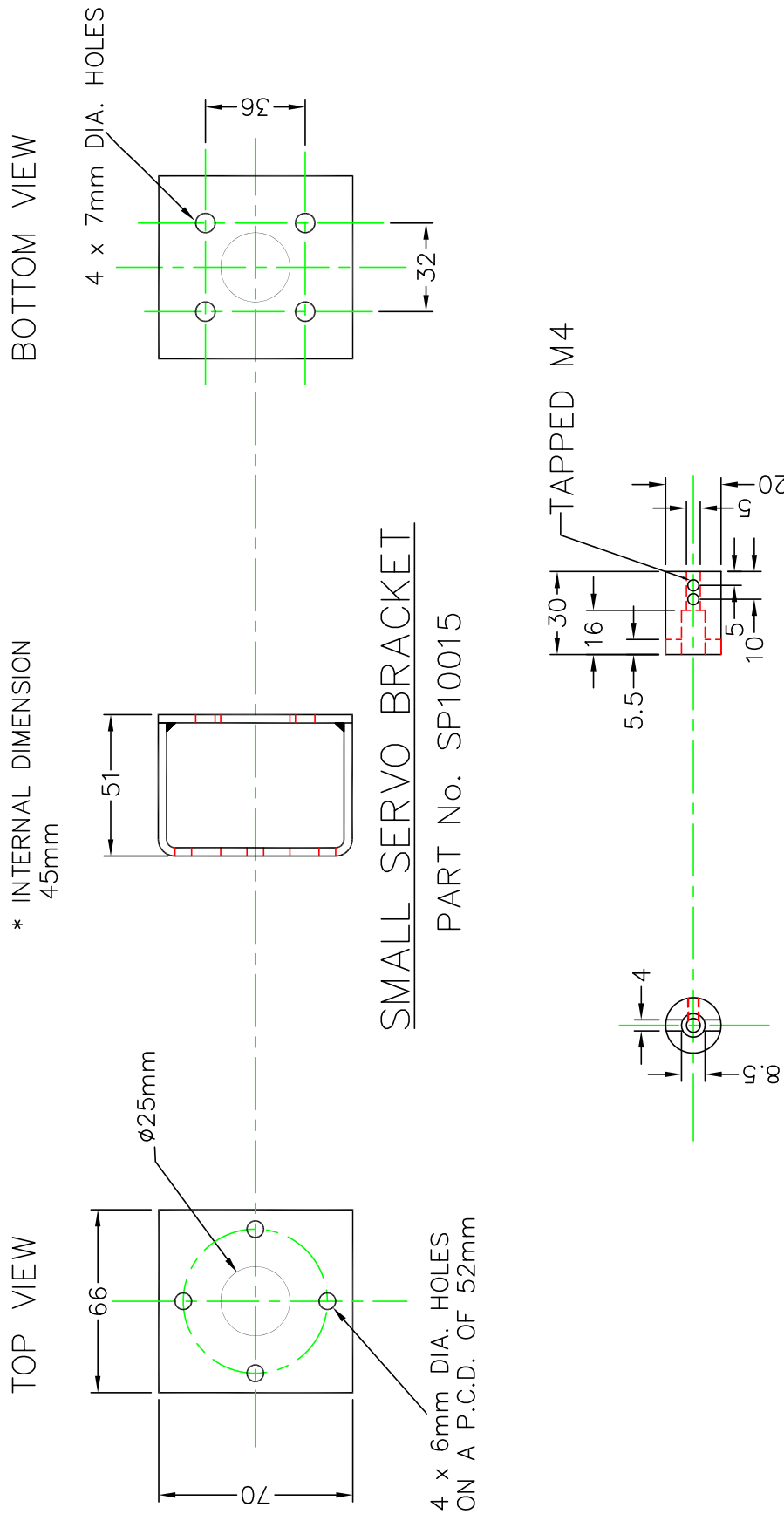


Specification	
Supply voltage	24V/ 230V/ 110V, 50Hz/60Hz
Output shaft torque	4Nm (3ft lbs)
Operating angle	0 - 90°
Max rated power	3W
Ambient temperature	0°C to 60°C (32°F to 140°F)
Industrial protection rating	IP54, NEMA13
Mounting angle	360°
Positioning	M.M. Drive
Drive motor	Synchronous
Body material	High impact acrylonitrile butadiene styrene (ABS)
Gear material	Polyoxymethylene
Weight	0.57kg
Dimension	100 x 84 x 65.5mm
Wiring connection (230V)	PG11 gland
Wiring connection (24V)	½" conduit aaptot (blanking plug)
Lid screws	4 x M4x10 Stainless steel socket head
Lid screw torque	0.2 0 0.4 Nm
Body mounting screws	2 x M5x25 Stainless socket head
Body mounting torque	1.2 - 2.6 Nm

2.1.1 Small Servomotor Mounting Bracket and Coupling



Small Servomotor Mounting Bracket and Coupling - Dimensions



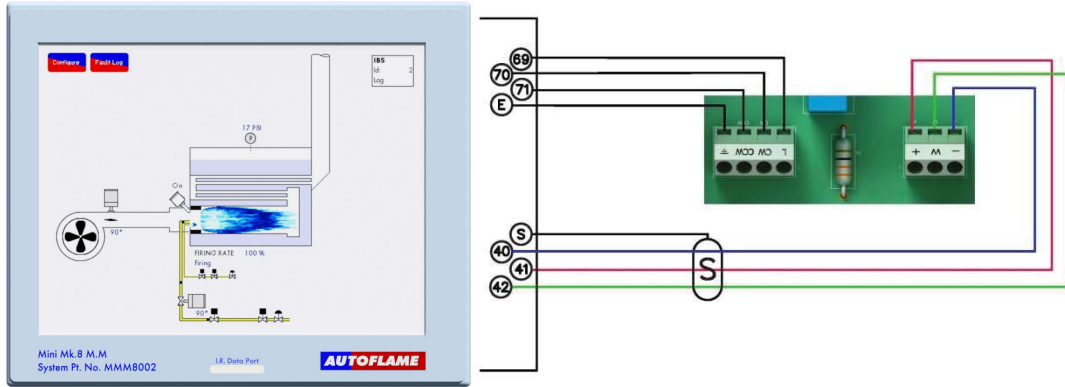
Drawing No. 4716-A

2.1.2 Servomotors – Direction Change

MOTOR CLOCKWISE ROTATION

FIG. A

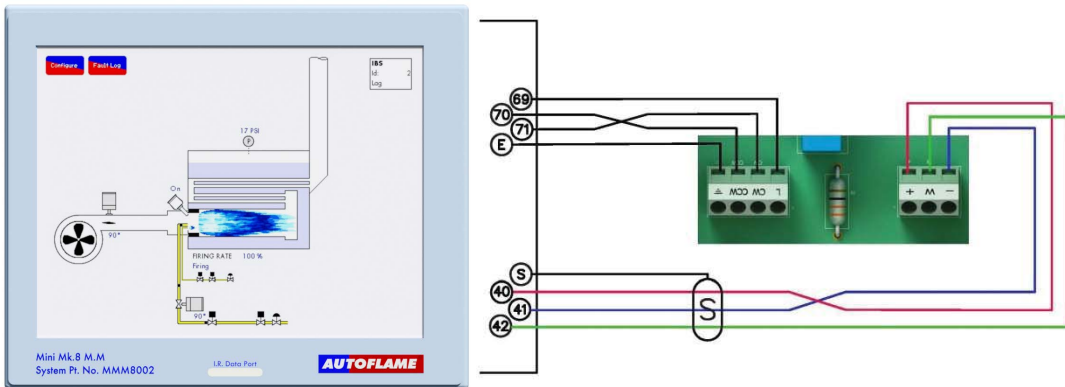
M.M. MODULE



MOTOR ANTICLOCKWISE ROTATION

FIG. B

M.M. MODULE



FOR ILLUSTRATION PURPOSES FUEL MOTOR CONNECTIONS ARE SHOWN.

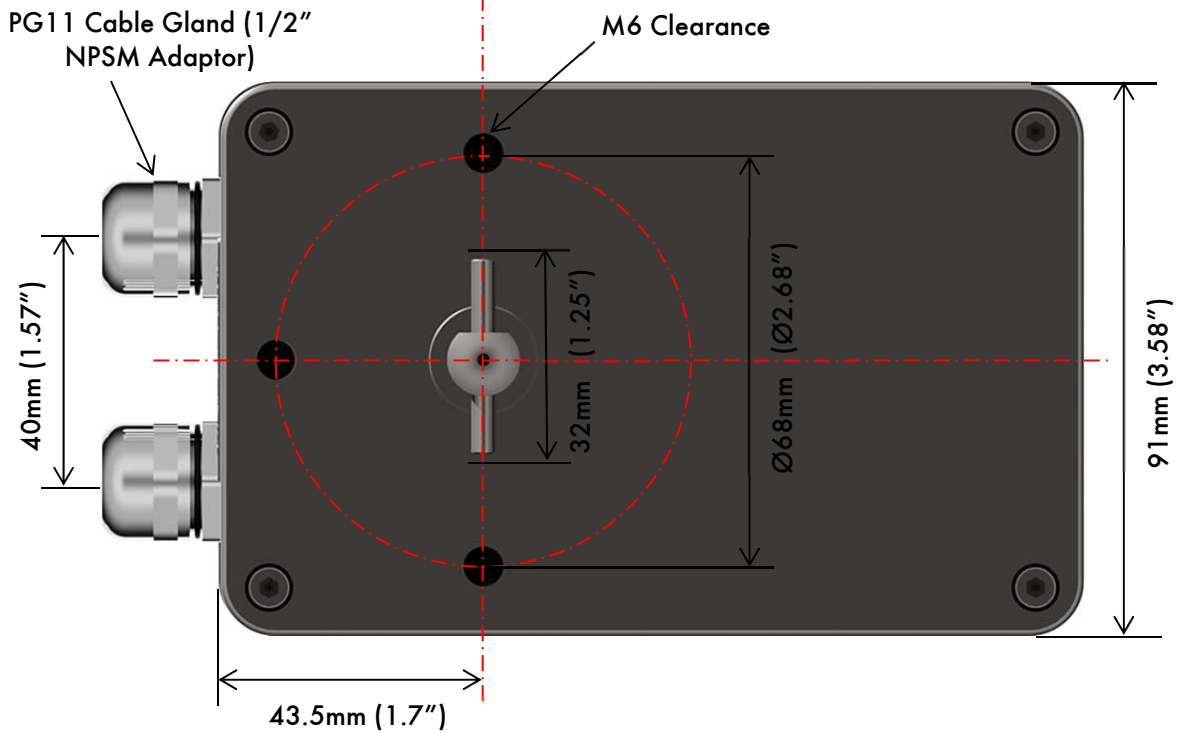
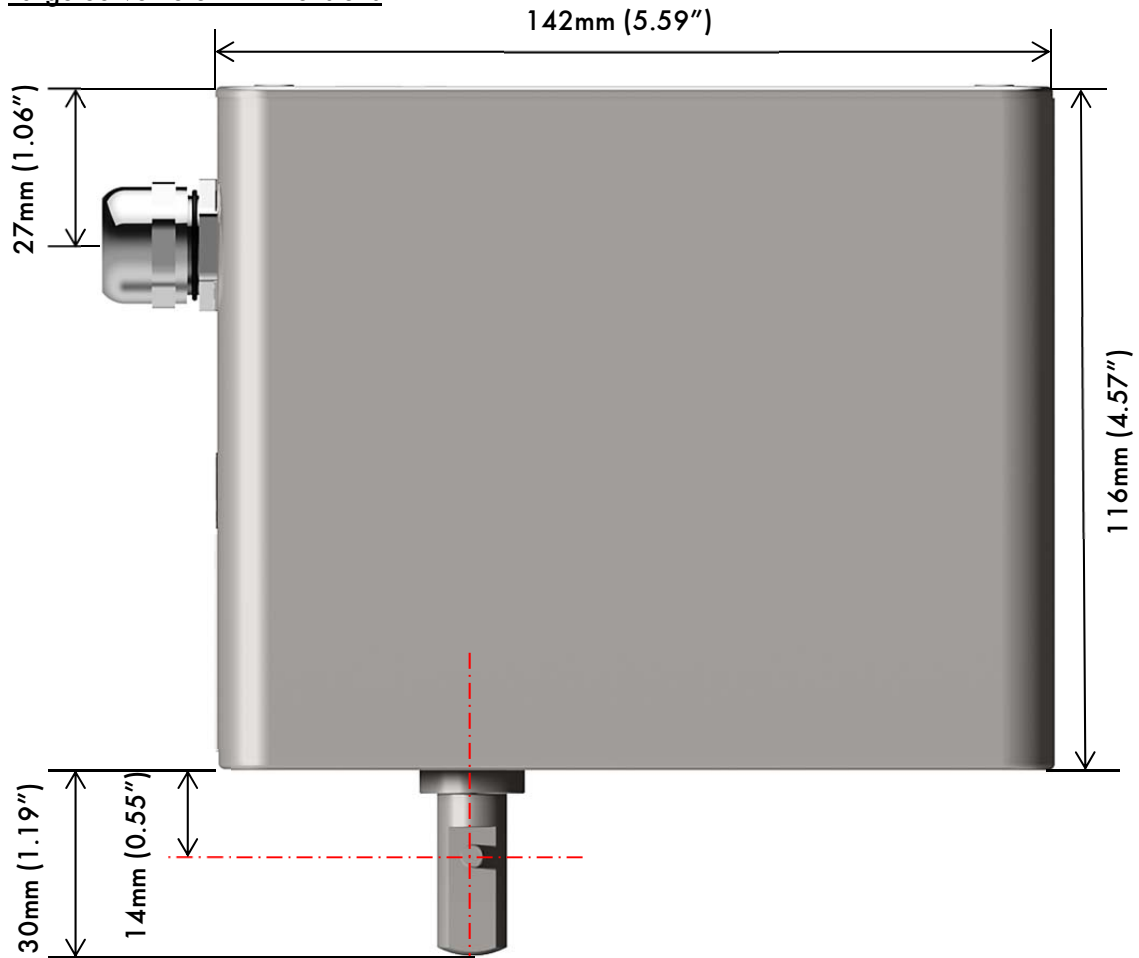
Drawing shows direction change for small and large servomotors, and Mini Mk8 M.M. and Mk7 M.M.

2.2 Large Servomotor



2 Servomotors

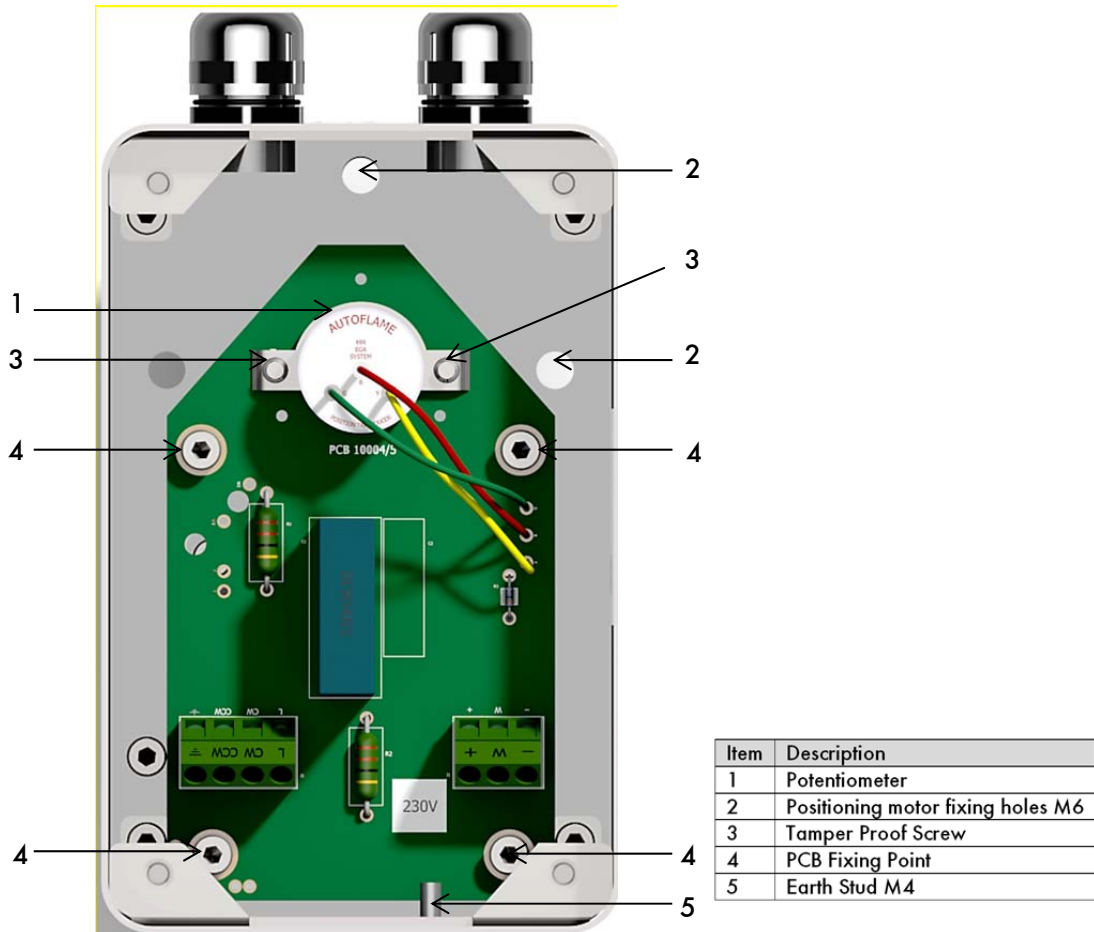
Large Servomotor - Dimensions



2 Servomotors

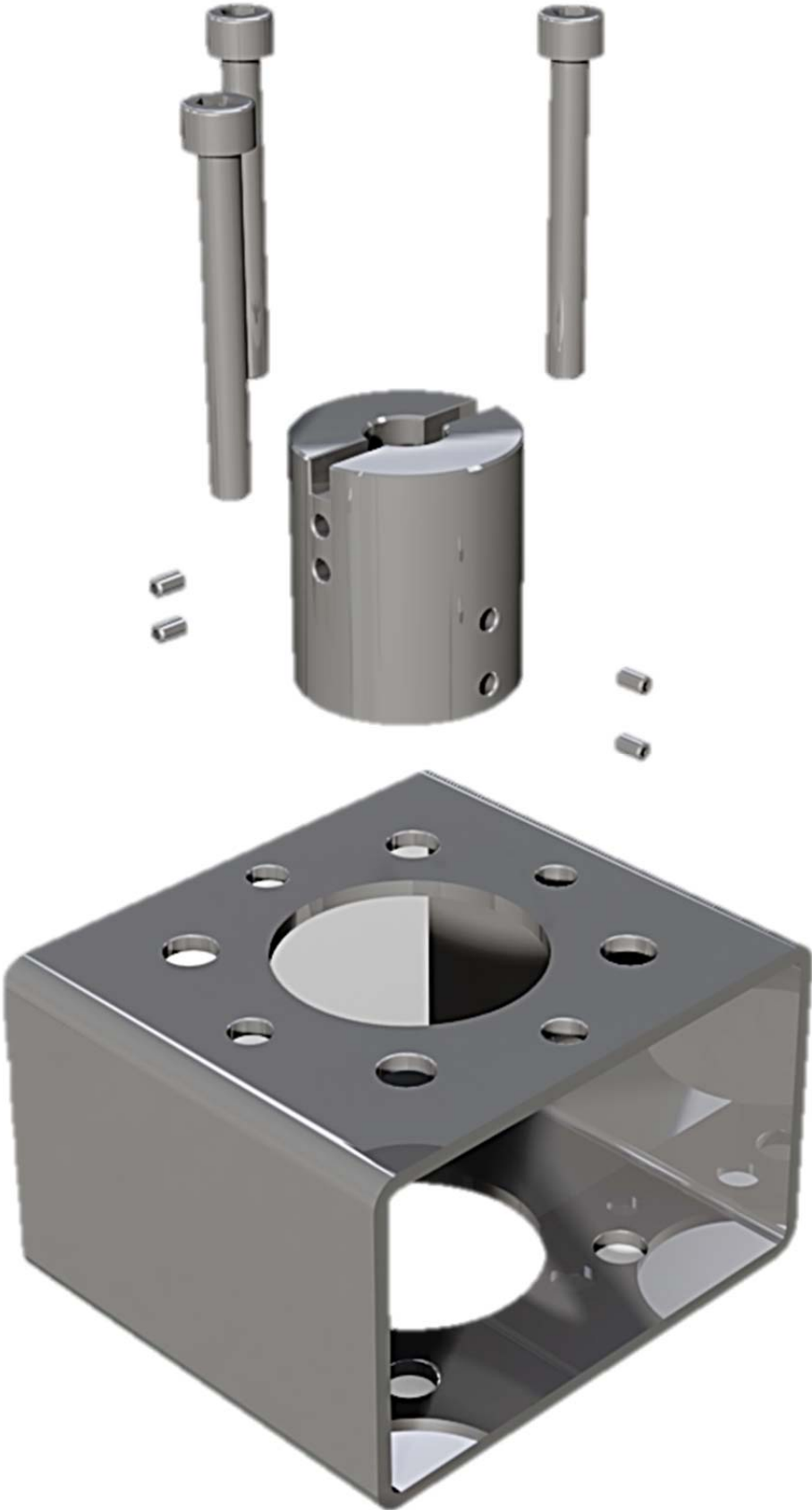
Note: Servomotors must only be installed and adjusted by an Autoflame certified technical engineer.

To adjust the potentiometer, loosen the tamper proof screws using a tamper proof screwdriver available from Autoflame. Use fingers only to adjust the position of the potentiometer. After adjustment, ensure tightness, do not over tighten. Do not raise the potentiometer from the PCB.

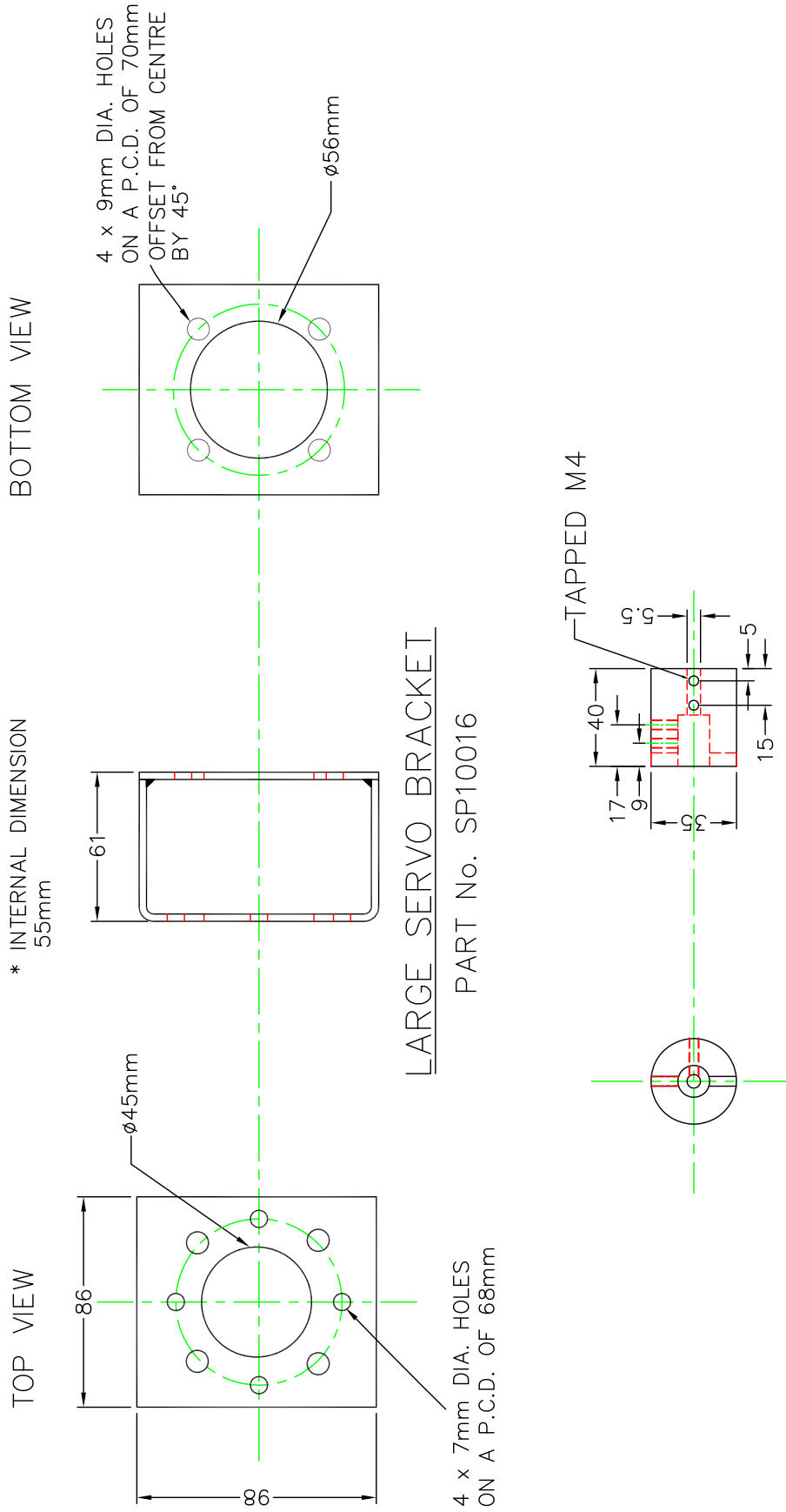


Specification	
Supply Voltage	24/230V, 50/60Hz
Output Shaft Torque	25Nm/18ft lbs
Operating Angle	0-90°
Operating Time	Nominal 30 seconds
Max Power Rated	9W
Ambient Temperature	0°C to 60°C/32°F to 140°F
Industrial Protection Rating	IP54/NEMA 13
Mounting Angle	360°
Positioning	MM Drive
Drive Motor	Synchronous
Body Material	Mild Steel CR4
Coating	Interpon 700 Powder Coat
Weight	1.85kg
Dimensions	142x116x91mm
Wiring Connection (230V)	PG11 Gland
Wiring Connection (24V)	½" Conduit adaptor/ blanking plug

2.2.1 Large Servomotor Mounting Bracket and Coupling



Large Servomotor Mounting Bracket and Coupling - Dimensions



Drawing No. 4716-B

2.3 Industrial Servomotor

2.3.1 Overview

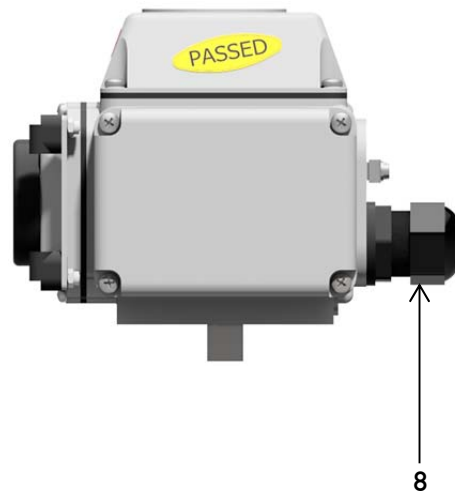
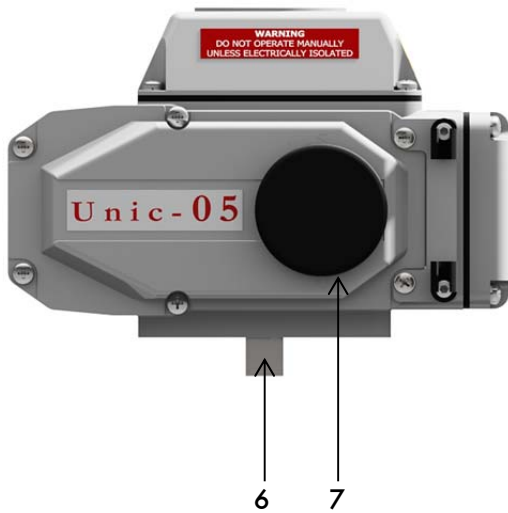
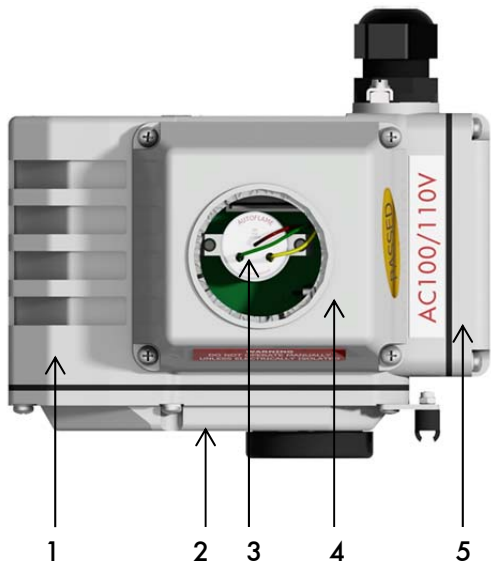
The industrial servomotor is a rotary type electric actuator, suitable for use with the M.M. module. The body is made with die-cast aluminium, and it is light, compact, highly efficient and powerful.

Features:

- Light and compact
- Easy to handle and suitable for use in narrow spaces
- Simple structure design
- Trouble-free mounting on air damper, maintenance and testing
- Manual operation function crank handle supplied with the servomotor
- Manual operation is only possible when the power is discontinued, with the attached manual crank handle. If manual operation is performed whilst the unit has power, this will cause damage.
- Protect function
- Thermal protector is built in to prevent motor burnout by overloading.
- Easy for wiring
- Connection is simplified by using a terminal block inside

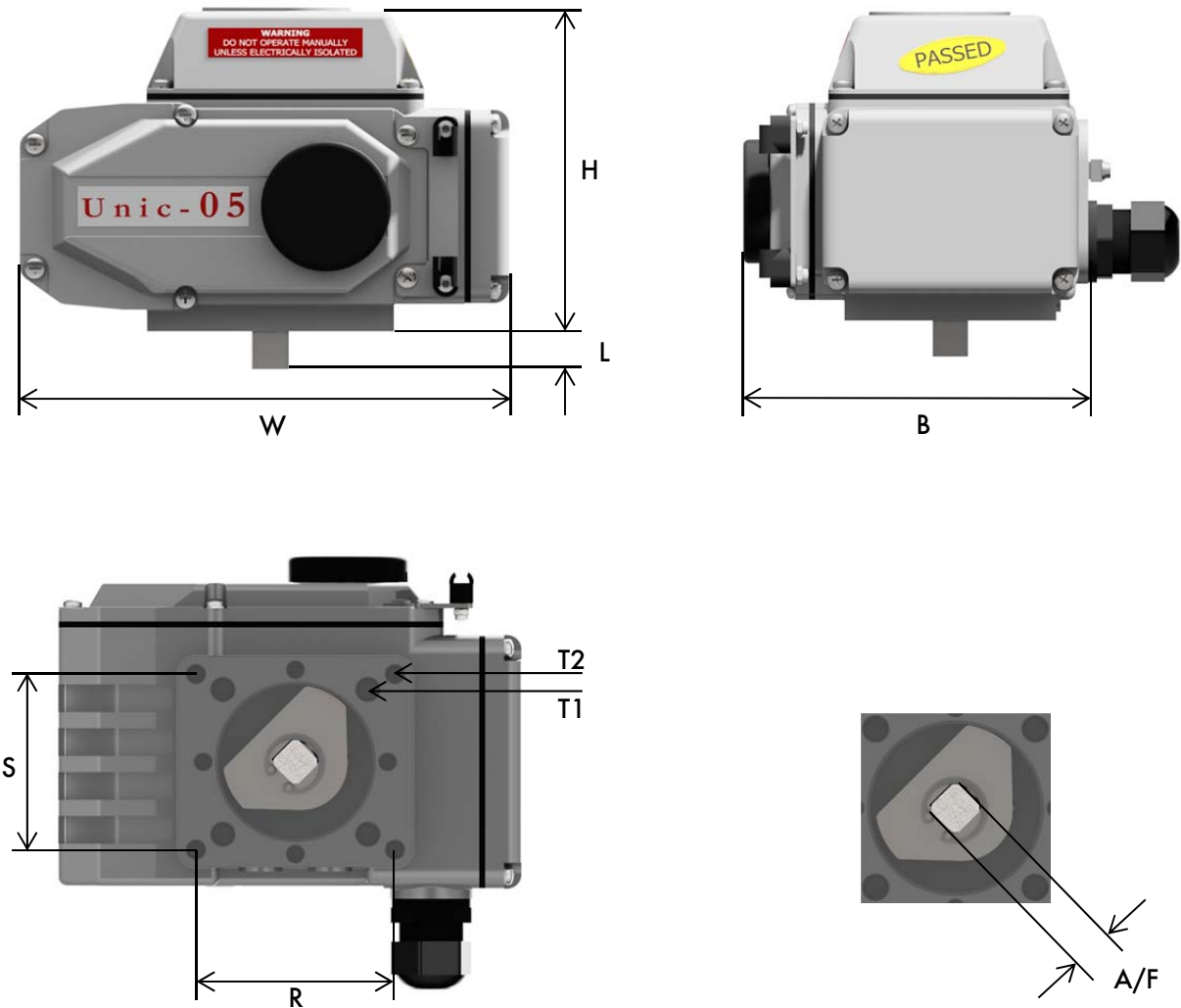


2.3.2 External Drawings



Number	Name
1	Body
2	Drive unit cover
3	Autoflame feedback potentiometer
4	Power instruments cover
5	Control unit/terminal strip cover
6	Output shaft
7	Manual handle shaft
8	Cord lock for conduit connection

2.3.3 Dimensions



Metric Units:

Part Number	Torque	Dimensions			Shaft			Dimensions		
	Nm	W	H	B	L	A/F	R	S	T1	T2
MM10070 -Unic 05	39.2	159	111	115	12	12	68	60	M8	M6
MM10072 -Unic 10	98	208	137	123	16.5	15	82	70	M8	M6
MM10074 -Unic 20	126	257	145	157	26.5	23	118	84	M10	M10
MM10078 -Unic 40	392	257	145	157	26.5	23	118	84	M10	M10

Imperial Units:

Part Number	Torque	Dimensions			Shaft			Mounting		
	ft lbs	W	H	B	L	A/F	R	S	T1	T2
MM10070 -Unic 05	29	6.26	4.37	4.53	0.47	0.47	2.68	2.36	M8	M6
MM10072 -Unic 10	72	8.19	5.39	4.84	0.65	0.59	3.23	2.76	M8	M6
MM10074 -Unic 20	144	10.12	5.71	6.18	1.04	0.91	4.65	3.31	M10	M10
MM10078 -Unic 40	289	10.12	5.71	6.18	1.04	0.91	4.65	3.31	M10	M10

2 Servomotors

2.3.4 Specifications

Item	Specification
Power	220/240VAC 50/60Hz 110VAC 60 Hz
Output Shaft Torque	MM10070 - 39.2Nm (29 Lb.ft) MM10072 - 98Nm (72 Lb.ft) MM10074 - 196Nm (144 Lb.ft) MM10078 - 392Nm (289 Lb.ft)
Operating Angle	0 - 90 degrees
Operating Time	15 - 30 seconds/ 50Hz (nominal)
Protect System	Thermal protector built in
Ambient Temperature	-25°C - 55°C (-13F - 131F)
Rated Current	MM10070 - 0.4A/ 200V (0.75A/ 100V) MM10072 - 0.3A/ 200V (0.6A/ 100V) MM10074 - 0.45A/ 200V (1A/ 100V) MM10078 - 0.9A/ 200V (2A/ 100V)
Insulation Resistance	100Mohm/ 500VDC
Withstand Voltage	1500VAC/ minute
Manual Operation	Crank handle attached
Stopper	Mechanical stopper - open/ close adjustable
Enclosure	IP65/ NEMA4
Mounting Angle	360 degrees - all directions
Positioning	M.M drive
Drive Motor	MM10070 - 8W (E type) MM10072 - 20W (E type) MM10074 - 30W (E type) MM10078 - 90W (E type)
Body material	Die cast aluminium ADC - 12
Coating	Baking varnish
Weight	MM10070 - 2Kg (4.4lbs) MM10072 - 4.5Kg (9.9lbs) MM10074 - 9Kg (19.8lbs) MM10078 - 9.5Kg (20.9lbs)
Wiring Conduit	½" NPT

The industrial servomotor is available as explosion proof with ATEX approval for hazardous environments:

Industrial Servomotor Unic 10, 230V	98Nm, 72 ft lbs. Ex nA nL IIC T4	MM10072/EXP
Industrial Servomotor Unic 10, 120V	98Nm, 72 ft lbs. Ex nA nL IIC T4	MM10072/110/EXP

2.3.5 Installation

The Autoflame product must only be installed, set-up, commissioned and adjusted by an Autoflame certified technical engineer.

Positioning:

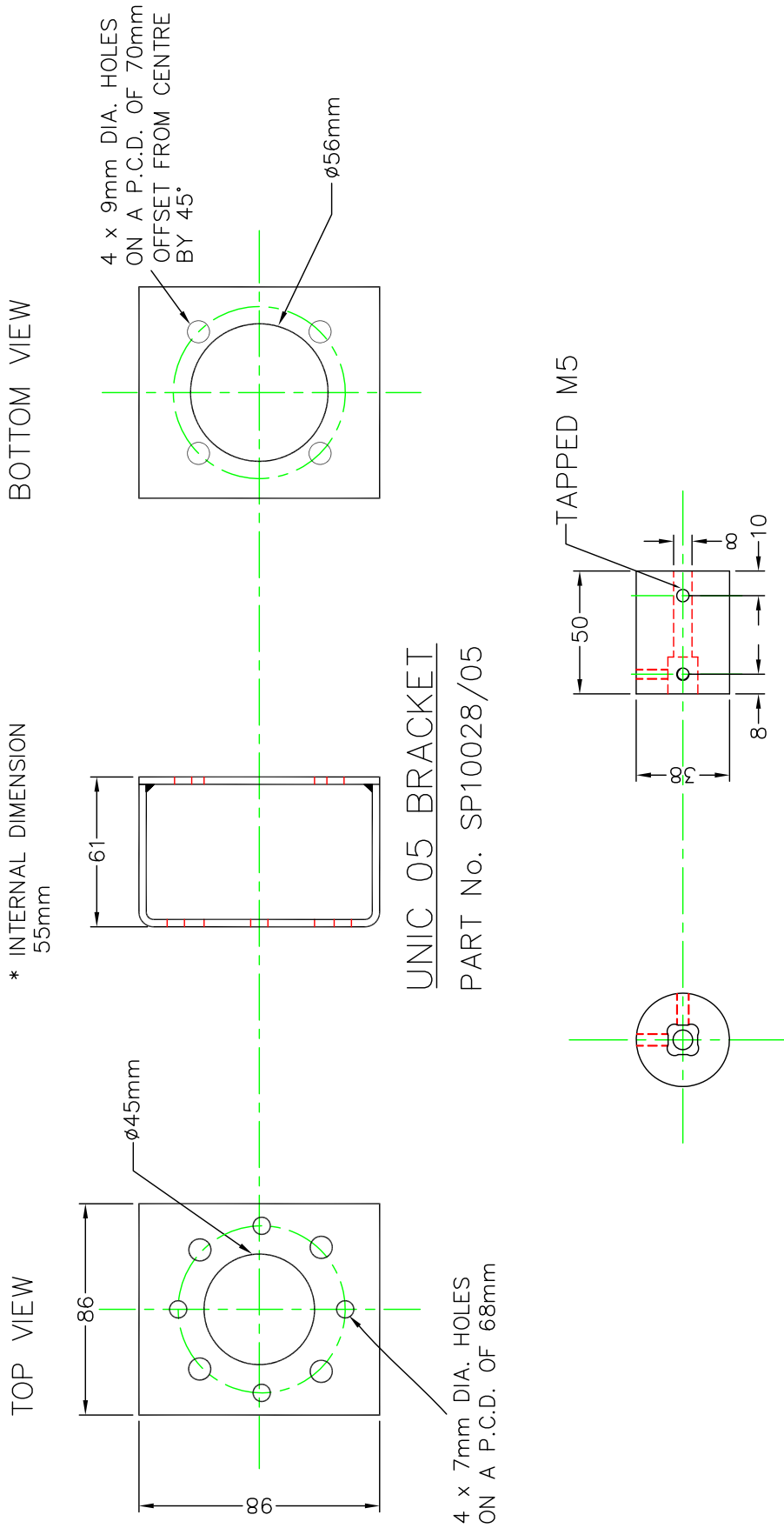
- Ambient temperature: -25°C to +55°C (-13°F to +131°F). Avoid hazardous ambient conditions.
- Depending on the condition of the installation, reserve spaces for the wiring conduit cover must be considered, in addition to manual maintenance works.

Mounting on Air Damper:

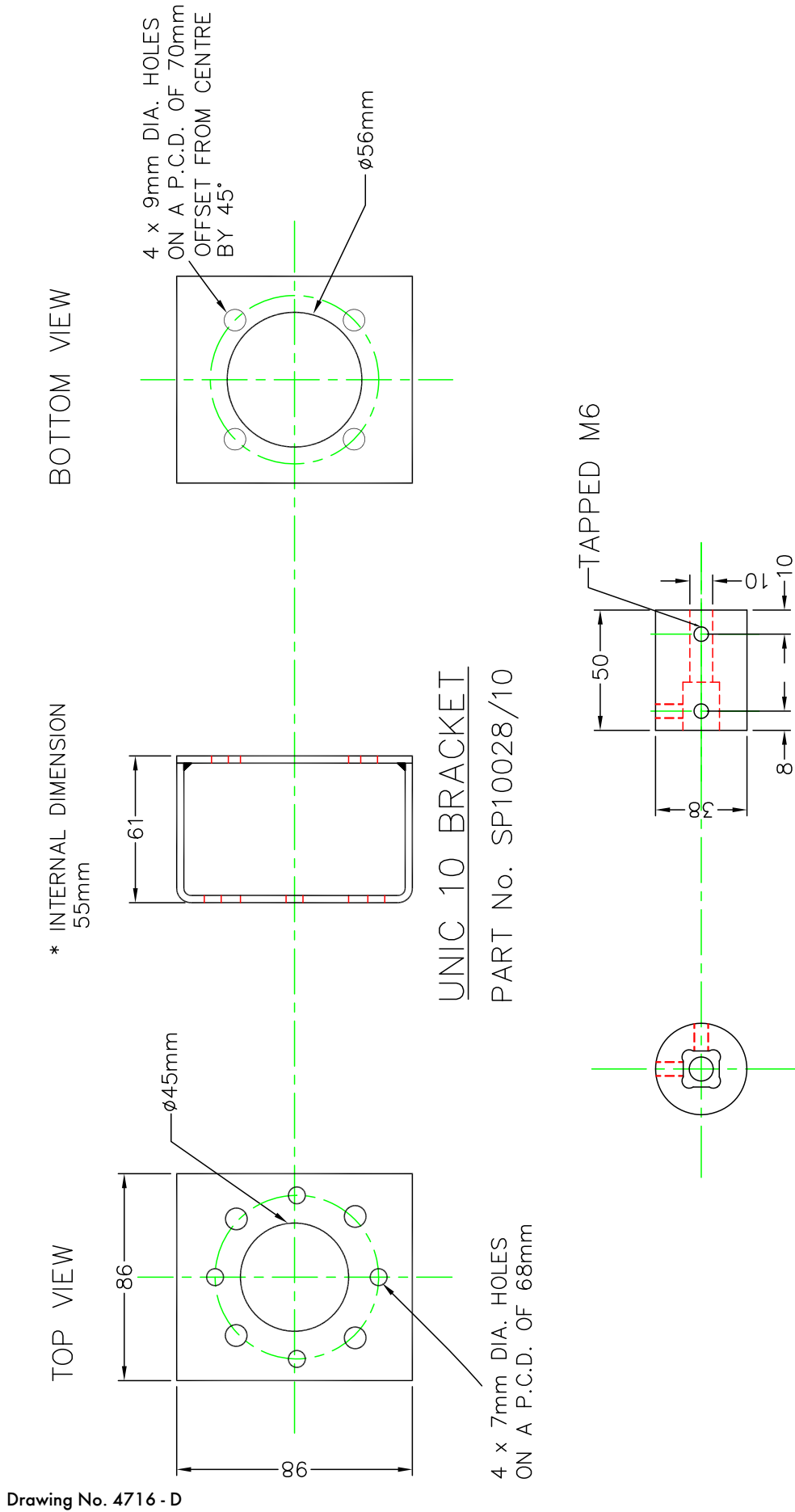


1. Ensure that the industrial servomotor is not powered before making manual operations.
2. Move the damper by hand and make sure that it is free. Then set it at the closed position. Make sure that the shaft is smooth in motion and there is no decentring/ inclination, by turning the manual handle.
3. Using the Autoflame supplied industrial servomotor mounting brackets, mount the servomotor to the bracket and secure. Then mount this assembly to the damper or valve ensuring that the damper or valve is in the fully closed position and then tighten the bolts and make sure that the assembly is fully secure.

2.3.6 Industrial Servomotor Mounting Bracket and Coupling – Dimensions



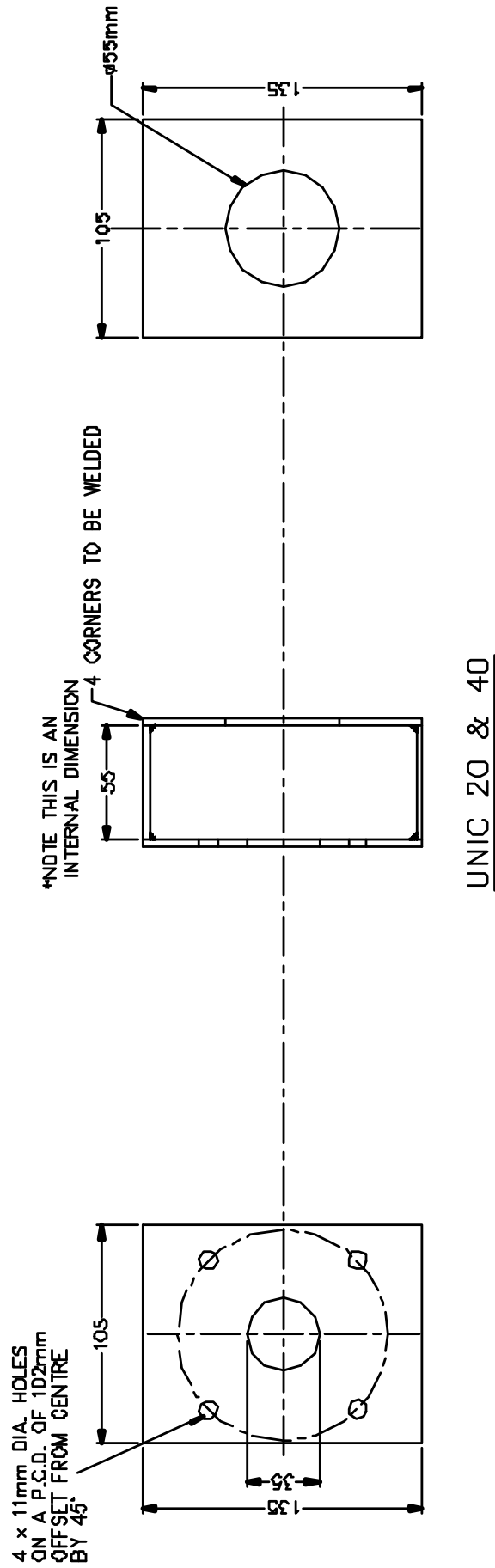
Drawing No. 4716-C



Drawing No. 4716 - D

UNIC 10 COUPLING
 PART No. SP10028/10/C (COUPLING ONLY)

2 Servomotors



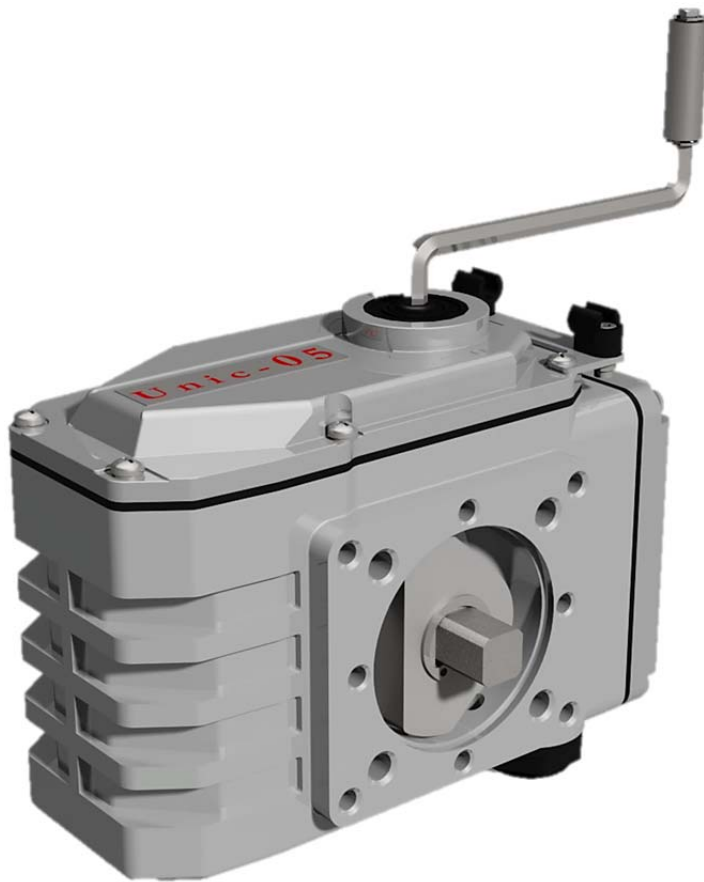
Drawing No. 4098

03.09.2015

Valves and Servomotors

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2.3.7 Manual Operation



Before starting manual operation check that the power source is switched off.

Remove rubber cap of the drive unit and insert the manual handle level into the hexagonal hole.

Turn the manual handle clockwise and the shaft moves in the CLOSE direction.

Turn the manual handle counter clockwise and the shaft moves in the OPEN direction.

Note:

Do not over-turn the handle with excessive strengths; as otherwise, it may cause problems with the other parts on the servomotor. Any excessive force may damage the servomotor. If power is not removed then the servomotor will try to return to the original position during manual operation. This may damage the servomotor and may cause physical injury.

Dimensions of Manual Handle

Opposite sides of hexagon shaft	MM10070/ MM10072	5mm
	MM10074/ MM10078	6mm
Length of handle	15mm	
	MM10070/ MM10072	100mm
	MM10074/ MM10078	120mm

Maintenance

- Lubrication: Since the unit is sufficiently lubricated for long life, and pressure proof with di-sulfied molybdenum grease (MOS2), no further lubrication is required.
- Periodical Test: In case the motor is very seldom rotated or after a long period of rest, it is suggested to have a periodical test and check if there is no irregularity. Remove power to the servomotor, and check manual operation as described above. Check wiring and visually inspect the integrity of the valve.

2.3.8 Troubleshooting

If the motor does not rotate electrically, one of the following could be the cause:

- Power is switched off – check live supply voltage
- Wire/terminals are disconnected – replace wire or properly connect on terminals
- Supply voltage is too low/high or incorrect – check the voltage with a meter
- No switched neutral – remove switched neutral connection and wire link to earth for both directions
- Effect of the terminal protector (due to a high/low ambient temperature or blocked damper) – lower/raise the ambient temperature or manually open/close the damper when power is removed from the motor

2.3.9 Industrial Servomotors – 4-20mA

The Unic industrial servomotors are available in 4-20mA versions, which enable the servomotors to be controlled via an analogue 4-20mA signal from the M.M.

The Mk7 M.M. has 7 channels of which channel 2 is used for air, and channel 7 is used for draft control with an expansion board. Channels 1, 3 and 4 can be used to control fuel valves and air dampers. Channels 5 and 6 can be used to control the VSD or Unic 4-20mA industrial servomotor via an analogue 4-20mA input and output. The Mini Mk8 M.M. has 4 channels, of which channel 2 is used for air. Channel 4 can be used to control the VSD or Unic 4-20mA industrial servomotor via an analogue 4-20mA input and output.

The servomotor would receive the 4-20mA via the VSD terminals on the M.M. (terminals 1-6 on the Mk7 M.M., and 1-12 on the Mini Mk8 M.M.)

2.4 Servicing Servomotors

It is good practice to check the Autoflame equipment periodically for the integrity of the installation. An important aspect of the system installation is the mechanical assemblies associated with the servomotors i.e. mounting brackets and couplings. The servomotor checks should include:

- Overall mechanical soundness – look for corrosion or mechanical damage
- Couplings and associated linkages should be tight
- Any associated set screws and fixings should be secure
- Mechanical pins (roll pins, split pins) should not show corrosion and fatigue
- When the burner is off and power has been securely isolated, remove the servomotor from the damper/valve and ensure that the damper/valve does not require excessive torque to operate. Make sure the servomotor is working within its recommended torque rating.

It is good practice to follow these guides:

- Do not stand on the servomotors as this may cause internal damage to the PCB and potentiometer leading to a system failure
- Do not remove the PCB inside the servomotor as this will affect the integrity of the repeatability, and also void any warranty that may apply to the unit
- Unless the servomotor has been supplied with NEMA4 (IP65) fixings, it is important that the servomotor is not subjected to an environmental condition exceeding the standard NEMA14 (IP54) rating.

2.4.1 Servomotor Torque

The servomotors will generate torque level in excess of the stated amount in the parts list, however the servomotors should be kept within the given torque levels for safety.

It is imperative that the damper or valve being controlled by the servomotor is tested using a torque meter to ascertain the torque requirement. In both cases the valve or damper must be tested with a realistic loading i.e. with air or gas pressure applied to the valve or damper. It is recommended that a nominal 20% is added to the measured torque value to determine the type of servomotor required for the application. This nominal 20% will take into account any environmental factors such as dust or moisture experienced between service intervals.

The Autoflame system will indicate an error condition in a normal operating condition when the servomotor torque levels are exceeded. However, in the unlikely event of the combustion parameters changing outside the control of the system e.g. sudden gas pressure change, calorific fuel variation or any other boiler related problems, a rapid change in a combustion process (explosion) may be experienced leading to mechanical damage or personal injury. Therefore it is important that the burner and M.M. are serviced on a regular basis by a factory trained certified technician.

3 WATER LEVEL VALVES

Water valves are universal for feedwater, TDS, and bottom blowdown function.

1/2" and 3/4" water level valves must be used with large servomotors. Industrial unic 05 servomotors must be used 1" and 1 1/2", and industrial unic 10 for 2" water valves. for water valves bigger than 3/4".

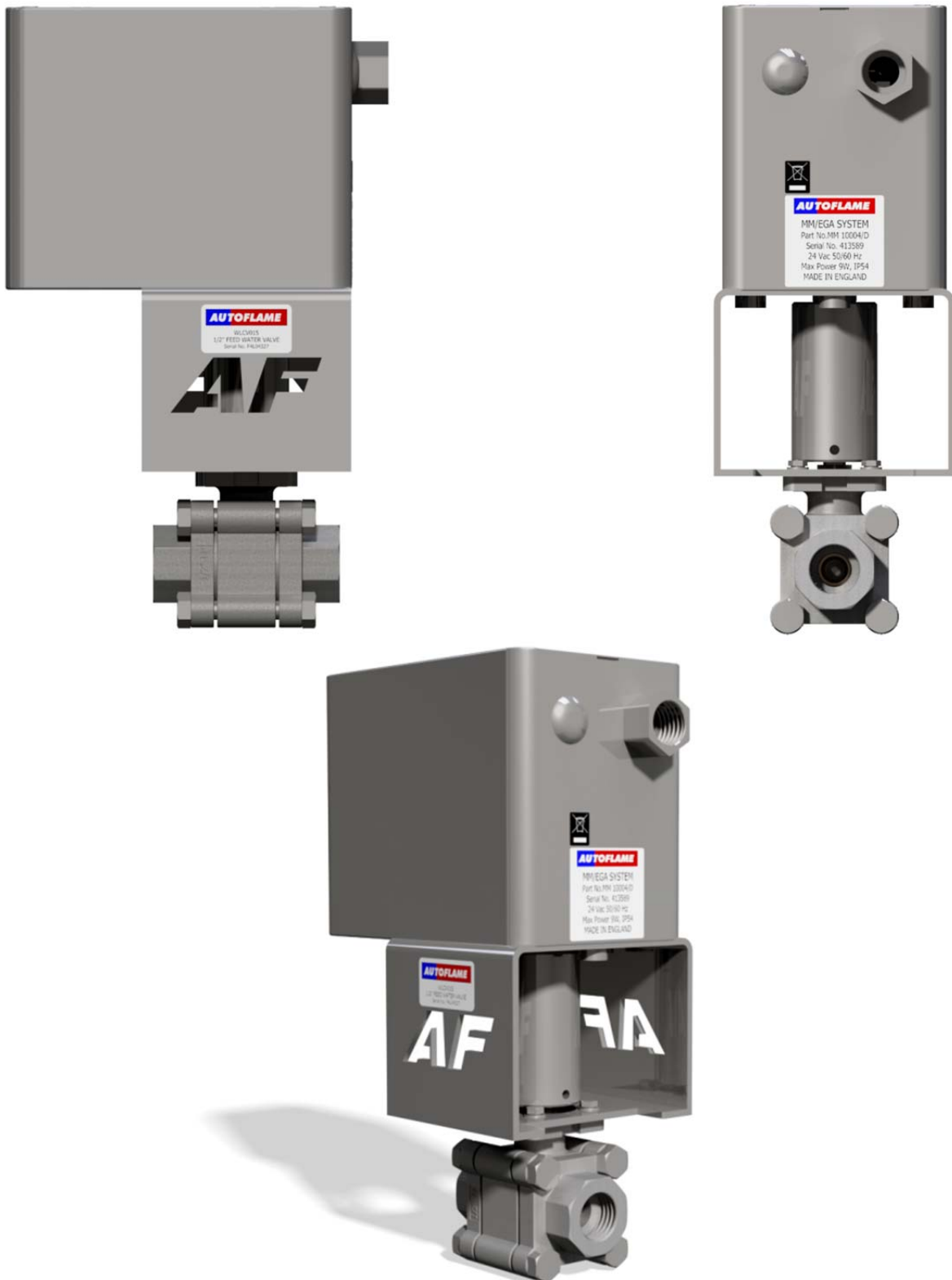
Valve Type	Size	Part No.	Servomotor		
			Large	Unic 05	Unic 10
Threaded Feed Water BSP/ NPT	15mm (1/2")	WLCVO15	•		
	20mm (3/4")	WLCVO20	•		
Flanged Feed Water PN40	25mm (1")	WLCVO25/FL		•	
	40mm (1 1/2")	WLCVO40/FL		•	
	50mm (2")	WLCVO50/FL			•
Flanged Feed Water ANSI 300lb	25mm (1")	WLCVO25/FLU		•	
	40mm (1 1/2")	WLCVO40/FLU		•	
	50mm (2")	WLCVO50/FLU			•
Threaded TDS BSP/ NPT	15mm (1/2")	TDS70001/M15	•		
	20mm (3/4")	TDS70001/M20	•		
Flanged Bottom Blowdown PN16/40	25mm (1")	BBV025FL		•	
	40mm (1 1/2")	BBV040FL		•	
	50mm (2")	BBV050FL			•
Flanged Bottom Blowdown ANSI 300lb	25mm (1")	BBV025FLU		•	
	40mm (1 1/2")	BBV040FLU		•	
	50mm (2")	BBV050FLU			•

Max operating pressure 29Bar (425 PSI)
 Max operating temperature 235°C (455°F)

Note: Autoflame water level probes are rated at maximum 27Bar (392 PSI) and 230°C (446°F).

3 Water Level Valves

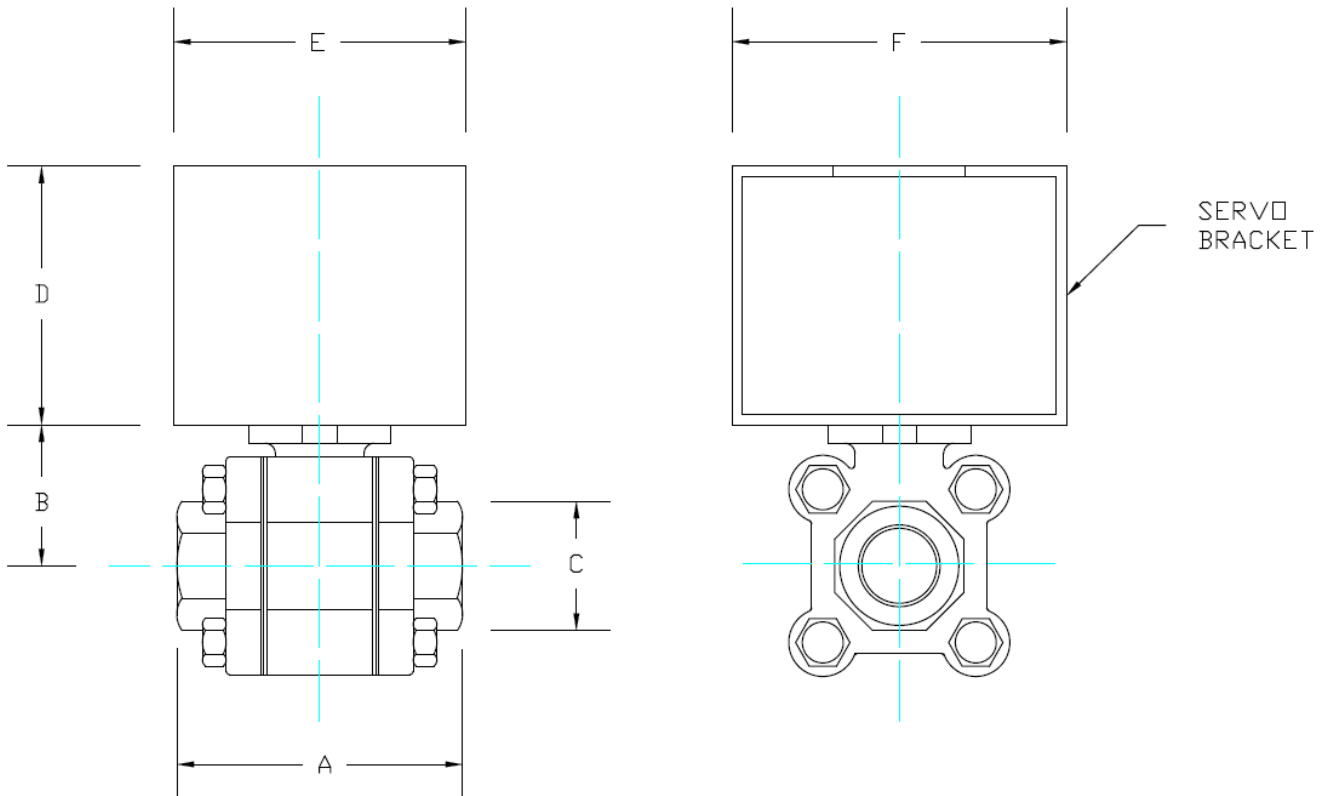
3.1 Threaded Water Valve



Note: 1/2" and 3/4" water level valves must be used with large servomotors. Industrial unic 05 servomotors must be used 1" and 1 1/2", and industrial unic 10 for 2" water valves.

3 Water Level Valves

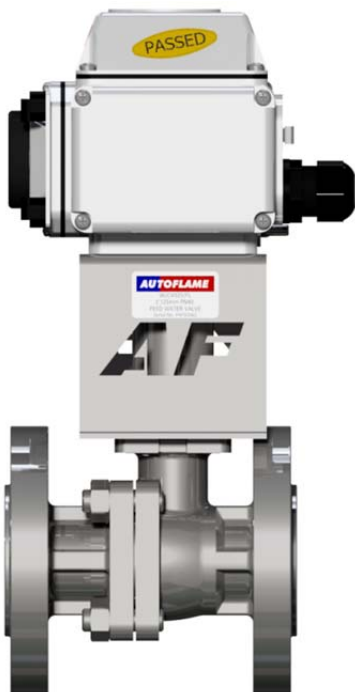
Threaded Water Valve - Dimensions



Dimensions: mm (inches)							
Part No.	Size	A	B	C	D	E	F
WLCVO15	15 (0.5)	76.0 (2.99)	36.9 (1.45)	32.0 (1.26)	76.5 (3.01)	86.0 (3.39)	98.5 (3.88)
WLCVO20	20 (0.75)	84.0 (3.31)	41.5 (1.63)	38.0 (1.50)	76.5 (3.01)	86.0 (3.39)	98.5 (3.88)

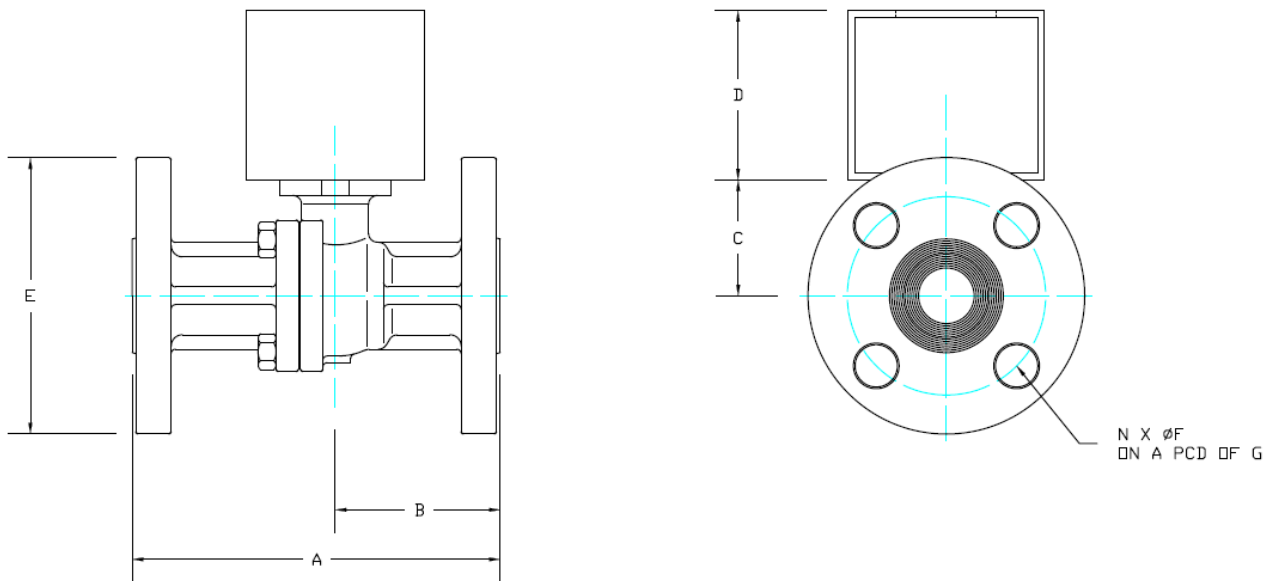
Note: 1/2" and 3/4" water level valves must be used with large servomotors. Industrial unic 05 servomotors must be used 1" and 1 1/2", and industrial unic 10 for 2" water valves.

3.2 Flanged Water Valve



3 Water Level Valves

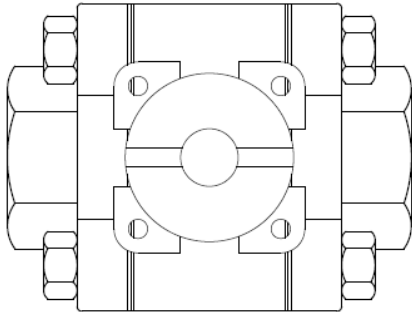
Flanged Water Valve – Dimensions



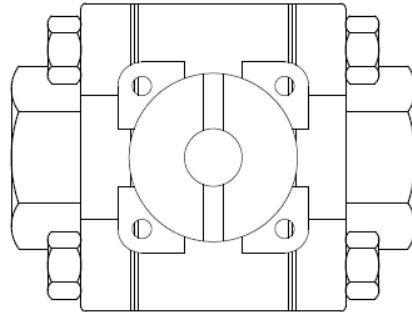
Dimensions: mm (inches)									N (No. Holes)
Part No.	Size	A	B	C	D	E	F	G	
WLCVO25/FL	25 (1)	125.0 (4.92)	53.0 (2.09)	52.0 (2.05)	76.0 (3.00)	115.0 (4.53)	14.0 (0.55)	85.0 (3.35)	4
WLCVO40/FL	40 (1.5)	140.0 (5.51)	57.5 (2.26)	66.0 (2.60)	76.0 (3.00)	150.0 (5.91)	18.0 (0.71)	110.0 (4.33)	4
WLCVO50/FL	50 (2)	150.0 (5.91)	63.0 (2.48)	74.9 (2.95)	76.0 (3.00)	165.0 (6.50)	18.0 (0.71)	125.0 (4.92)	4
WLCVO25/FLU	25 (1)	165.0 (6.50)	73.9 (2.91)	52.0 (2.05)	76.0 (3.00)	124.0 (4.88)	19.0 (0.75)	88.9 (3.50)	4
WLCVO40/FLU	40 (1.5)	190.5 (7.50)	83.0 (3.27)	66.0 (2.60)	76.0 (3.00)	155.5 (6.12)	22.0 (0.87)	114.0 (4.49)	4
WLCVO50/FLU	50 (2)	215.9 (8.50)	100.0 (3.94)	74.9 (2.95)	76.0 (3.00)	165.0 (6.50)	19.0 (0.75)	127.0 (5.00)	8

Note: 1/2" and 3/4" water level valves must be used with large servomotors. Industrial unic 05 servomotors must be used 1" and 1 1/2", and industrial unic 10 for 2" water valves.

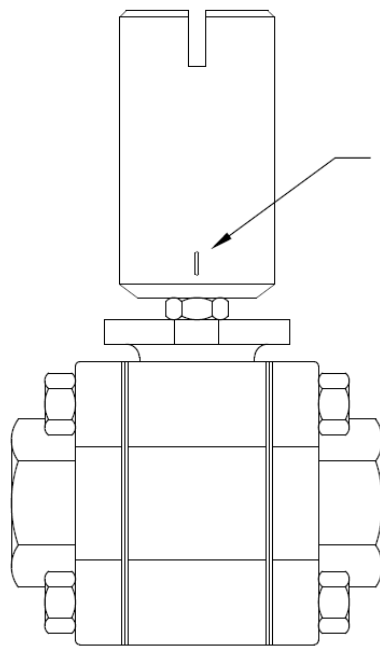
3.3 Coupling Open and Closed Positions



OPEN POSITION



CLOSED POSITION



CLOSED / OPEN
POSITION INDICATION

3.4 Feed Water Valve Sizing

Obtain one value from the system relating to the units from the column headings, then compare with values using all tables and select the valve with the closest higher match, to size correctly. The feed water valves are available as threaded or flanged. The valves have a very low pressure drop so when replacing an existing feed water valve the valve size required may decrease by more than one.

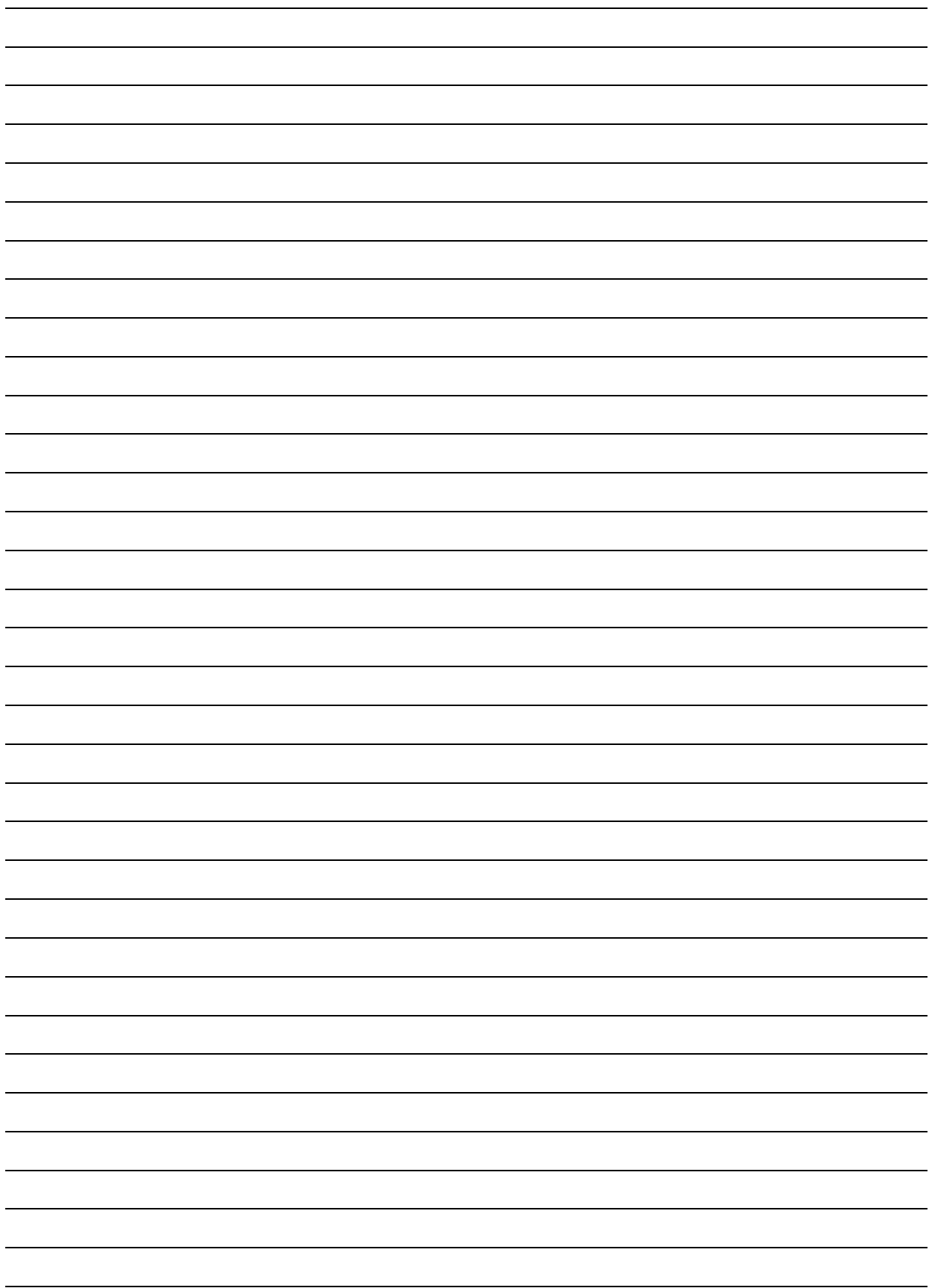
Autoflame Part No. WLCV015 - 1/2" feed water valve water flow calculations @20 °C								
Water Velocity		Pressure Drop Across Valve		Water Flow Rate			Steam Flow Rate	
Ft/sec	M/sec	ΔP PSI	ΔP Bar	G/hr (imp)	GPM (imp)	US GPM	lbs/hr	Kg/hr
6	1.82	1	0.07	160	2.6	3.2	1600	727
9	2.74	2	0.14	235	3.9	4.7	2350	1068
15	4.57	5	0.34	380	6.3	7.6	3800	1727
21	6.40	10	0.68	560	9.3	11.2	5600	2545
26	7.90	15	1.03	700	11.6	14	7000	3182
32	9.73	20	1.38	820	13.6	16.4	8200	3727

Autoflame Part No. WLCV020 - 3/4" feed water valve water flow calculations @20 °C								
Water Velocity		Pressure Drop Across Valve		Water Flow Rate			Steam Flow Rate	
Ft/sec	M/sec	ΔP PSI	ΔP Bar	G/hr (imp)	GPM (imp)	US GPM	lbs/hr	Kg/hr
8	2.43	1	0.07	460	7.7	9.2	4600	2090
12	3.65	2	0.14	665	11	13.3	6650	3022
19	5.79	5	0.34	1100	18.3	22	11000	5000
28	8.53	10	0.68	1630	27.1	32.63	16300	7409
34	10.34	15	1.03	2000	33.3	40	20000	9090
40	12.16	20	1.38	2400	40	48	24000	10909

Autoflame Part No. WLCV025 - 1" feed water valve water flow calculations @20 °C								
Water Velocity		Pressure Drop Across Valve		Water Flow Rate			Steam Flow Rate	
Ft/sec	M/sec	ΔP PSI	ΔP Bar	G/hr (imp)	GPM (imp)	US GPM	lbs/hr	Kg/hr
13	3.96	1	0.07	1560	26	31.2	15600	7091
21	6.4	2	0.14	2300	38.3	46	23003	10456
32	9.75	5	0.34	3800	63.3	76	38005	17275
46	14.02	10	0.68	5600	93.9	112	56007	25458
60	18.24	15	1.03	7000	116.6	140	70008	31822
70	21.28	20	1.38	8200	136.6	164	82011	37278

Autoflame Part No. WLCV040 - 1 1/2" feed water valve water flow calculations @20 °C								
Water Velocity		Pressure Drop Across Valve		Water Flow Rate			Steam Flow Rate	
Ft/sec	M/sec	ΔP PSI	ΔP Bar	G/hr (imp)	GPM (imp)	US GPM	lbs/hr	Kg/hr
17	5.17	1	0.07	4700	78.3	94	47005	21366
25	7.60	2	0.14	6700	11.6	134	67007	30458
39	11.86	5	0.34	11200	186.6	224	112015	50916
60	18.24	10	0.68	16500	275	330	165022	75010
75	22.80	15	1.03	20000	333.3	400	200028	90922
90	27.36	20	1.38	24000	400	480	240033	109126

Autoflame Part No. WLCV050 - 2" feed water valve water flow calculations @20 °C								
Water Velocity		Pressure Drop Across Valve		Water Flow Rate			Steam Flow Rate	
Ft/sec	M/sec	ΔP PSI	ΔP Bar	G/hr (imp)	GPM (imp)	US GPM	lbs/hr	Kg/hr
21	6.38	1	0.07	10000	166.6	200	100014	45461
31	9.42	2	0.14	15000	250	300	150020	68191
46	13.99	5	0.34	24000	400	480	240033	109106
72	21.89	10	0.68	36000	600	720	360049	163659
85	25.84	15	1.03	44000	733	880	440061	200028
110	33.44	20	1.38	51000	850	1021	510072	231851



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