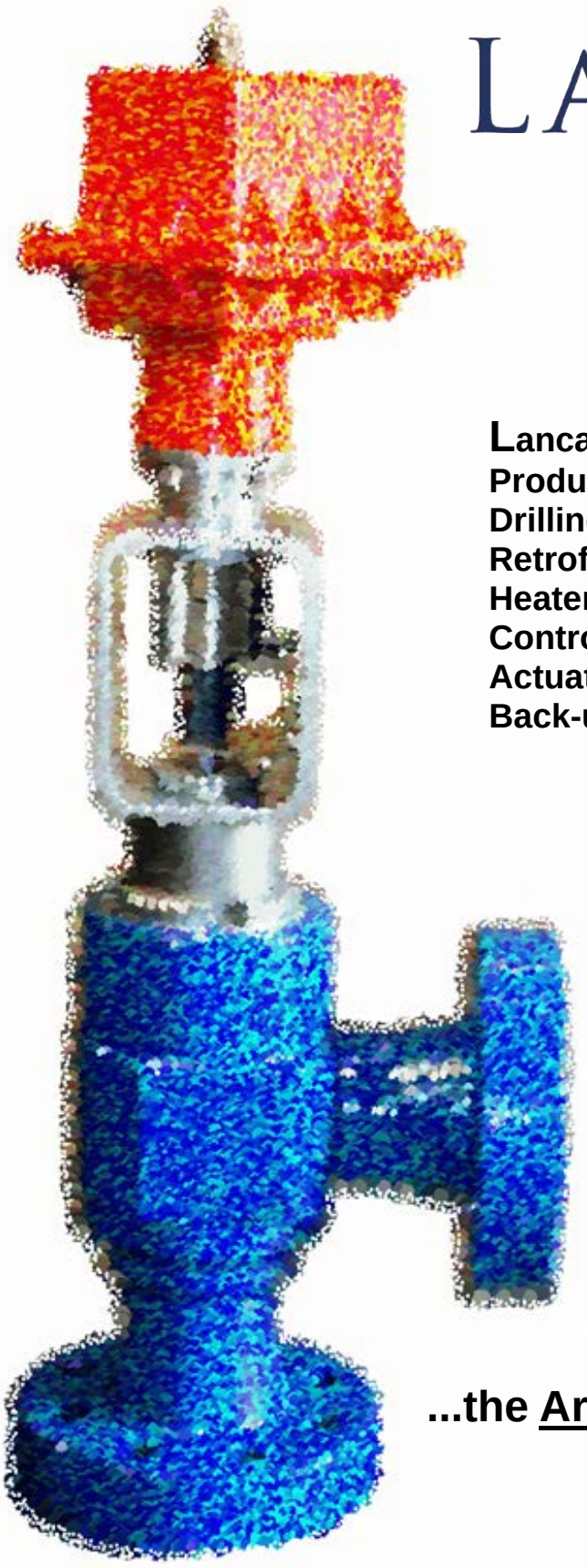
IFA

LANCASTER
FLOW AUTOMATION
an QSI company



Lancaster High Performance
Production Chokes
Drilling Chokes
Retrofit Kits
Heater Chokes
Control Chokes
Actuators
Back-up Power Supplies

...the Art of Flow Control

OGSI's line of Lancaster production chokes offers unparalleled features and options. The operating torque is over **90% less** than typical commodity style designs. Thus, the ease with which this equipment may be automated is without equal. With options like having no elastomers in direct contact with well bore fluids together with metallic bonnet seals, neither safety or performance has been compromised. A stainless steel micrometer style position indicator provides for precise readout of the orifice size. Although not a requirement of API 6A, It remains on the choke even when mounting rotary type actuators.

With only 27 lb.-ft. of torque required for closing the stem against 15,000 psig downstream of the orifice, a small 17-pound (24 vDC) electric actuator (drawing 2.6 amps. at these conditions) is all that is required for automation. The unit may be operated using solar power and is easily removed while the choke is in service and under pressure. The choke is available in needle, cage, multi-stage cage, positive, and adjustable/ positive style trims. Regardless of the adjustable trim style, any type of actuator may be used with our standard components. Our choke and retrofit kits have been operating successfully offshore in the Gulf of Mexico since 1995.

When you are serious about your flow control, LFA provides genuine solutions.

- No elastomeric seals (o-rings) are in contact with well bore fluids. Standard seal temperature range is -40ºF to 325ºF. Several styles of non-metallic and metallic bonnet seals are offered.

- Our equipment requires extremely low operating torque (1.8 lb.-ft. per 1,000 psi downstream pressure). Our non-rotating stem design allows for numerous material combinations to be easily qualified to API 6A PR2 requirements. Automation has never been easier.

- A single bonnet and trim configuration may be utilized for manual, linear pneumatic piston or diaphragm, linear hydraulic, or rotary electric actuation. Converting from needle type trim to cage type trim (and vice versa) only requires replacement of the stem, seat, and orifice indicator.

- The large diameter orifice indicator is stainless steel and markings are accurate to the nearest .0001@. The entire surface of the orifice indicator is always visible and displays trim design details and open/close directions. An adjustable stainless steel pointer provides for easy reading of the choke orifice size.

- Tungsten carbide trim is standard. Needle type (linear), multi-orifice cage type (linear and equal percent), and multi-orifice multi-stage type (linear) type trims are available with a single configuration bonnet and body. Positive and adjustable/positive trim types are also available. The full length of all carbide cages and seat liners are held in compression with a separate carrier.

- Seat assemblies utilize a non-threaded design that cannot become loosened from flow induced vibration while in service which could lead to seat-to-body seal failures and body damage.

- Our compact stainless operating lever, a mere 7.5@ long (190.5 mm), is easily removed when automating. The stem position locking feature is integral with the operating lever and is adjustable.

- All bodies are forged and have a reinforced inlet nozzle area; large body reservoirs reduce internal erosion and extend trim life. A body cavity bleeder plug with the addition of a bonnet nut safety interlock is optional.

- Our manufacturing processes **do not include** salt bath nitriding of wetted trim components (and their critical sealing surfaces). This results in improved corrosion resistance of the standard stainless steel trim components as well as superior seal performance.

- The bearing housing is completely sealed and provided with a stainless steel lubrication fitting. Switch from manual to rotary actuation by simply removing the operating lever and mounting the small electric actuator. If a problem is ever encountered, the actuator may be safely removed and the operating lever reinstalled, all while the choke is throttling and under pressure.

- Our lead screw is isolated from the environment to provide long life and consistently low operating torque. The special design and metallurgy utilized provide for an efficiency of almost 33%.

- Retrofit bonnet kits and actuators are available for a number of commodity type choke styles and control valve assemblies. Installation of these kits is cost effective and usually easier than a routine trim change.

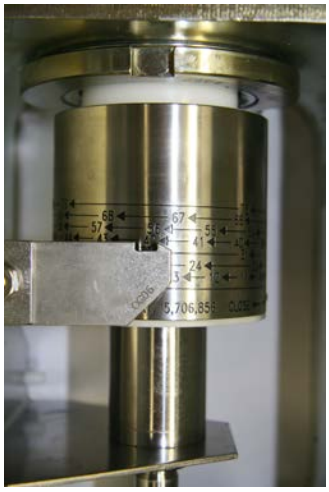
- Modulating 24 vDC electric actuation is available and may be operated using solar power. 120/240 vAC units are also available. Our actuator is capable of making over 55 moves or Asteps@ per single revolution which equates to a stem adjustment of <0.003" (.076 mm). The weight of our standard 24 vDC actuator is only 23 pounds (10.43 kg), which includes the mounting kit. The actuator is NEMA 4/7 and is suitable for Div. 1 hazardous locations, class I and II, Groups C, D, E, F, and G. Our small actuator will drive the choke stem even when the choke is pressure locked at P1 = P2 = 15,000 psig. The compact size of the overall package makes it ideal for use in FPSO turrets, on offshore platforms - especially unmanned platforms, or any other remote locations.

Unlike so many others, the Lancaster production choke is <u>NOT</u> just another copy, clone, or modification of a commodity choke line, it is the next generation of choke design. Each individual component has been designed to maximize unimaginable product interchangeability, metallurgy, performance, safety, and automation. It is the first truly low torque design where API 6A PR2 requirements and automation were not an afterthought.

In a wellhead application, the choke should be the last valve to open and the first valve to close. No choke is easier to operate than this one. Whether you choose to automate or not, we recommend that you insist on installing a choke that operates easily, around the clock, at the working pressure stamped on the body. Install our user-friendly choke to save wear and tear on your gate valves and improve the overall safety of your well site operations.

Utilize our needle style trim to clean up or test your well prior to connecting the flow line. Then, if conditions dictate, install one of our cage trims to reduce noise and possible flashing or cavitation which may be encountered when producing water or condensate at high pressure drops along with the gas phase.

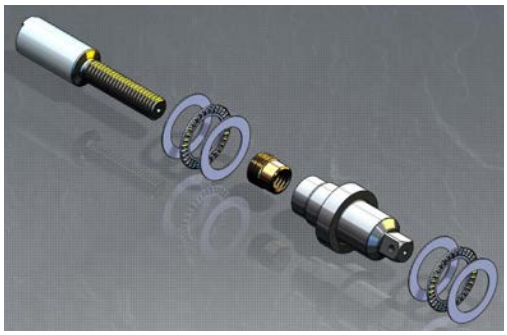
When desired, the actuator may be configured to fail in place, fail open, or fail closed. With the optional back-up power supply, the unit may be configured to fail closed on loss of power or command signal even in the event of a power failure. Weight of the 24 vDC actuator is a mere 23 pounds (10.43 kg) including the mounting kit.



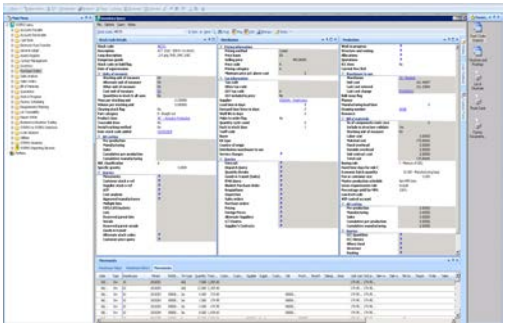
Stainless steel indicator drum. With markings to the nearest 0.0001 in., it is easy to read and remains in place when mounting rotary style electric actuators.

Simply remove the stainless operating lever and mount our 24 vDC electric actuator when you want to automate. The unit may be powered with a small solar array and will accept 4 different analog command signals. The actuator may be safely installed or removed while the choke is throttling and under pressure.

Lancaster Flow Automation has the personnel, products, equipment, tools, software, and imagination to take care of your flow control.

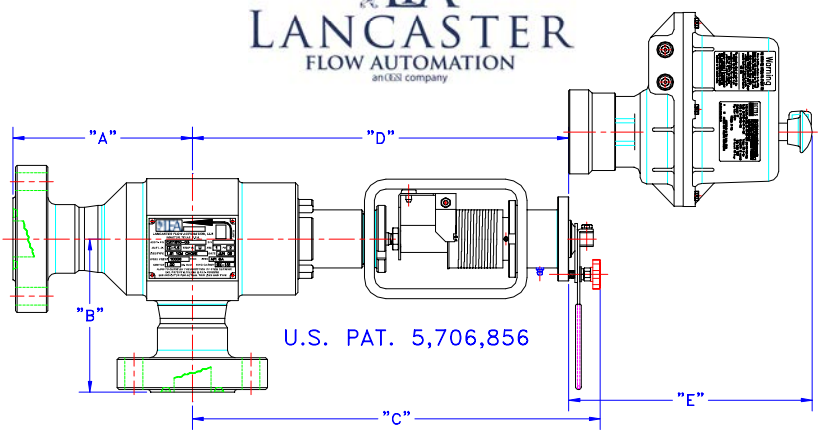


Precision 3D Modeling



Powerful Software for Manufacturing

LANCASTER FLOW AUTOMATION
an OEXI company



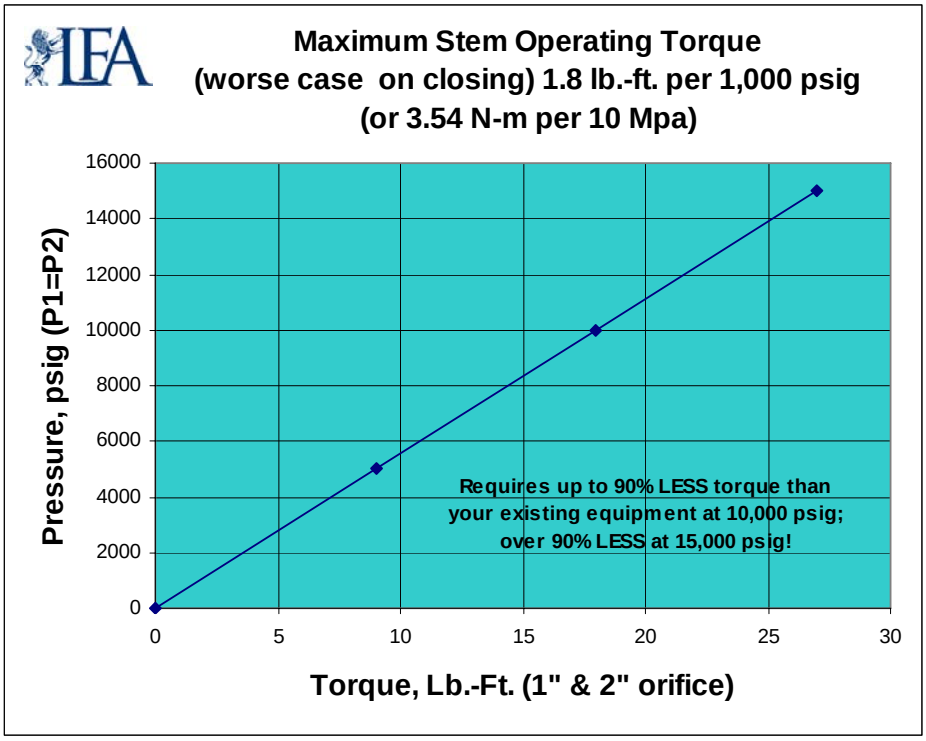
Common Lancaster Flow Automation Choke Sizes

Connection Size	Working Pressure psig	Dim. Ref.	A Outlet	B Inlet	C Manual Operator	D Mounting Flange
1.00" (25.4) Nom. Orifice (Adj.-Pos., 64/64 Linear Needle or 76/64 EP Cage), Max C_V = 26.5						
2-1/16" (52.39)	5,000	1"-H2	8.000 (203.20)	6.875 (174.63)	20.03 (508.76)	18.50 (469.90)
2-1/16" (52.39)	5,000	.75"-OCT	9.375 (238.13)	7.500 (190.50)		
2-9/16" (65.09)	5,000	TC	10.250 (260.35)	7.500 (190.50)		
1-13/16" (46.04)	10,000	1"-H2	8.813 (223.85)	7.688 (195.28)		
1-13/16" (46.04)	10,000	.75"-OCT	9.375 (238.13)	7.500 (190.50)		
2-1/16" (52.39)	10,000	1"-H2	8.813 (223.85)	7.688 (195.28)		
2-1/16" (52.39)	10,000	.75"-OCT	9.375 (238.13)	7.500 (190.50)		
1-13/16" (46.04)	15,000	.75"-OCT	10.125 (257.18)	7.500 (190.50)		
2-1/16" (52.39)	15,000	1"-H2	9.563 (242.90)	8.438 (214.33)		
1.50" (38.1) Nom. Orifice (Adj.-Pos. or 94/64 EP Cage), Max C_V = 39.0						
2-9/16" (65.09)	20,000	LFA	12.000 (304.80)	6.625 (168.28)	21.67 (550.42)	20.12 (511.05)
2.00" (50.8) Nom. Orifice (1" red. Trim, Adj.-Pos., 120/64 Linear Needle, 112 or 142/64 EP Cage), Max C_V = 88.0						
2-9/16" (65.09)	5,000	2"-H2	11.750 (298.45)	8.875 (225.43)	20.35 (516.89)	18.81 (477.77)
3-1/8" (79.38)	5,000	2"-H2	11.375 (288.93)	8.875 (225.43)		
2-9/16" (65.09)	10,000	TC	11.125 (282.58)	9.00 (228.60)		
2-9/16" (65.09)	10,000	2"-H2	11.750 (298.45)	10.375 (263.53)		
3-1/16" (77.79)	10,000	2"-H2	11.750 (298.45)	10.375 (263.53)		
4-1/16" (103.19)	10,000	LFA	11.625 (295.28)	10.750 (273.05)		
2-9/16" (65.09)	15,000	LFA	10.000 (260.35)	9.125 (231.78)		
3-1/16" (77.79)	15,000	LFA	11.250 (285.75)	10.375 (263.53)		
4-1/16" (103.19)	15,000	LFA	12.500 (317.50)	11.625 (295.28)		
3.00" (76.2) Nom. Orifice: (2" reduced Trim & 208/64 EP Cage), Max C_V = 189.1						
4-1/16" (103.19)	5,000	LFA	12.250 (311.15)	10.750 (273.05)	24.94 (633.48)	23.38 (593.85)
5-1/8" (130.18)	5,000	LFA	14.000 (355.60)	12.500 (317.50)		
5-1/8" (130.18)	10,000	LFA	14.375 (365.13)	12.875 (327.03)		
6" Hub-#44 (152.40)*	10,000	LFA	14.000 (355.60)	12.500 (317.50)	21.00 (533.40)	19.45 (494.03)

* "C" and "D" shown with 3" x 2" reduced orifice trim

1) Using our 24vDC actuator shown, "E" is 11.97"; Pneumatic & Hydraulic units are also available as well as other Electric units
2) For sizes or dimensions not shown, for ANSI flanges or hub connections, contact sales or engineering
3) In addition to "C", provide clearance for bonnet and trim removal as follows (worse case – with trim in fully closed position):
   1.0" (25.4) Nominal, add 7.81" (198.37) for needle trim; add 6.75" (171.45) for cage trim
   1.5" (38.1) Nominal, add 7.72" (196.09) for cage trim
   2.0" (50.8) Nominal, add 9.31" (236.47) for needle trim; add 7.75" (196.85) for cage trim
   3.0" (76.2) Nominal, add 8.72" (221.49) for cage trim (needle type trim is not offered above 2" nominal)
4) (xxx.xx) dimensions shown in parenthesis are in millimeters (mm)
5) Orifices in X/64ths are openings with the equivalent area of a circle with the diameter of X/64ths of an inch; 64/64ths = 1.00"
6) API 5,000 psig is equal to 34.473 MPa; 10,000 psig = 68.946 MPa; 15,000 psig = 103.420 MPa; 20,000 psig = 137.893 MPa.

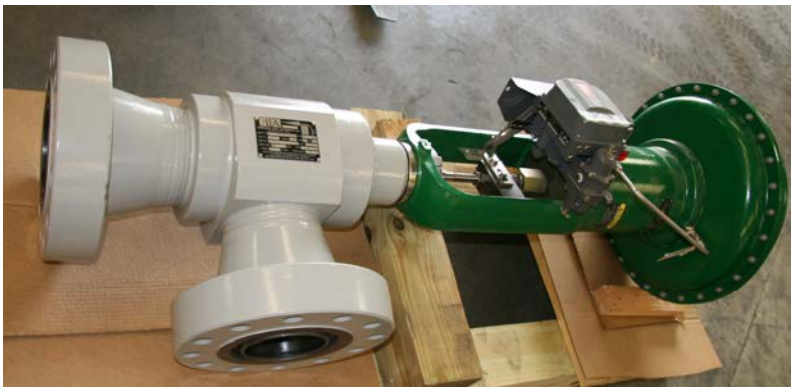
API Spec. 6A Temperature Classes					API Spec. 6A Material Requirements		
Class	Operating Range				Mat'l. Class	Minimum Material Requirements (for Chokes)	
	ºC min.	ºC max	ºF min.	ºF max		Bodies, Bonnets, End & Outlet Connections	Pressure Controlling Parts, Stems
K	-60	82	-75	180	**AA**	General Service	
L	-46	82	-50	180		Carbon or Low Alloy Steel	Carbon or Low Alloy Steel
N	-46	60	-50	140			
P	-29	82	-20	180	**BB**	General Service	
S	-18	66	0	150		Carbon or Low Alloy Steel	Stainless Steel
T	-18	82	0	180	**CC**	General Service	
U	-18	121	0	250		Stainless Steel	Stainless Steel
V	2	121	35	250	**DD**	Sour Service[a]	
Annex G, Table G.1						Carbon or Low Alloy Steel[b]	Carbon or Low Alloy Steel[b]
X	-18	180	0	350	**EE**	Sour Service[a]	
Y	-18	345	0	650		Carbon or Low Alloy Steel[b]	Stainless Steel[b]
Example of Combination Class					**FF**	Sour Service[a]	
P/U	-29	121	-20	250		Stainless Steel[b]	Stainless Steel[b]
●All LFA Bonnets are AISI 410 QTT (NACE) stainless or better ●All LFA Stems & Seats are ASTM A564 Type 630 HH1150 (NACE) stainless or better.					**HH**	Sour Service[a]	
						CRA's[b]	CRA's[b]
						"a" as defined by NACE Std. MR-0175	"b" in compliance with NACE Std. MR-0175
EE-0.5 denotes material class "EE" with a partial pressure limit of 0.5 psia for H_2S, see NACE MR-0175							



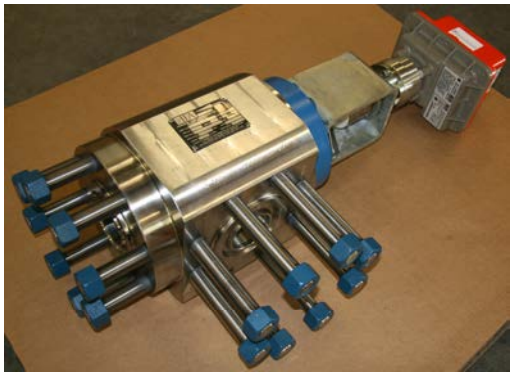
WARRANTY

LANCASTER FLOW AUTOMATION, LLC (LFA) warrants all PRODUCTS manufactured by it and bearing its name plate to be free from defects in materials or workmanship, under normal use in service, appearing within one year from the date of shipment by LFA, except that such warranty does NOT apply to any PRODUCTS which have been modified or subjected to improper handling, storage, operation, or maintenance. LFA's liability under its warranties is expressly limited to the repair or replacement of parts which prove to be defective in materials or workmanship within the warranty period. LFA shall be the sole judge of defects in materials and workmanship. Any claim(s) made pursuant to LFA's warranty shall be made in writing within ten (10) days after the discovery of the defect with respect to which the claim is made. Upon LFA's request, the claimant shall return the PRODUCTS with respect to which a defect is claimed to LFA's plant, Houston, Texas, with transportation charges prepaid, for inspection by LFA. All PRODUCTS replaced or repaired by LFA under its warranty shall be replaced or repaired F.O.B. LFA's plant, Houston, Texas.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER WRITTEN, ORAL, IMPLIED OR STATUTORY. NO WARRANTY OR MERCHANTABILITY OR FITNESS FOR A PURPOSE SHALL APPLY. LFA makes no warranty with respect to parts or accessories not wholly of LFA's manufacture, LFA's liability shall be limited to the extent of its recovery from the manufacturer of such products or parts under its liability to LFA.



5-1/8”-API 10,000 psig, full 3.00” orifice with pneumatic diaphragm actuator



3-1/16”-15M all Nickel Alloys, “HH”, PSL 3G (extra long 718 inlet studs for instrument flange)

2-9/16”-API 15,000 psig all stainless, replacement for CC20A HP, (no welding)

Initial phase of an automation project for an entire field

6”-10,000 psig

Automation of our chokes is even cost effective for land based projects

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