

# Flow Controls



## Remote Flow Control Valves

FCGT-02-A/B-\*\*\*-11-(S30)



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# Section I – Introduction

## A. Purpose Of Manual

This manual describes the basic operational characteristics and provides service, overhaul and parts information for the Vickers FCGT-02 Electrically Modulated Flow Control. The information contained herein pertains to the latest design series as listed in Table 2.

## B. General Information

1. **Related Publications** – Installation dimensions are not contained in this manual. The installation drawing listed in Table 1 is available from any Vickers application engineering office or from:

Vickers, Incorporated  
 Technical Publications  
 5445 Corporate Drive  
 P. O. Box 302  
 Troy, MI 48007-0302

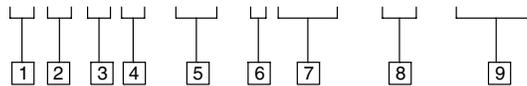
2. **Model Codes** – Variations within each basic model series are covered in the model code. Table 2 is a complete breakdown of the model codes covering these units. Service inquiries should always include the complete unit model code as noted on the nameplate.

Model	Drawing
FCGT-02-A-004-11	513850A
FCGT-02-B-004-11	
FCGT-02-A-028-11	
FCGT-02-B-028-11	
FCGT-02-A-220-11	
FCGT-02-B-220-11	
FCGT-02-A-530-11	
FCGT-02-B-530-11	

Table 1

## Model Code

**FCGT - 02 - \* (\*\*\*) - 11 - (S30)**



<p>1 Flow control valve</p> <hr/> <p>2 Check valve included</p> <hr/> <p>3 Manifold or subplate mounted</p>	<p>4 With torque motor for remote control</p> <hr/> <p>5 1/4 inch size</p> <hr/> <p>6 A – Model with sleeve for lower flow ranges                      B – Model without sleeve for higher flow ranges</p>	<p>7 Number x 10 equals resistance in ohms/ coil, e. g. 004 x 10 = 40 ohms                      004 – 40 ohms                      028 – 280 ohms                      220 – 2200 ohms                      530 – 5300 ohms</p> <hr/> <p>8 Design &amp; modification</p> <hr/> <p>9 F3 seals</p>
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Table 2. Model Code Breakdown

# Section II – Description

## A. General

Assembly of a typical FCGT flow control is shown in Figure 1. In general, the flow control consists of an electrical torque motor coupled to a metering spool. The metering spool and a compensated hydrostat stabilizes flow in the forward direction. A check valve is provided to allow reverse free flow through the valve.

FCGT flow controls are available in two flow ranges; 5 to 250 and 50 to 1000 cubic inches per minute, (in<sup>3</sup>/minute). Flow ranges are determined by different metering spool diameters. The smaller the metering spool, the lower the flow range.

## B. Application

Vickers application engineering personnel should be consulted to determine correct methods of installation and applications.

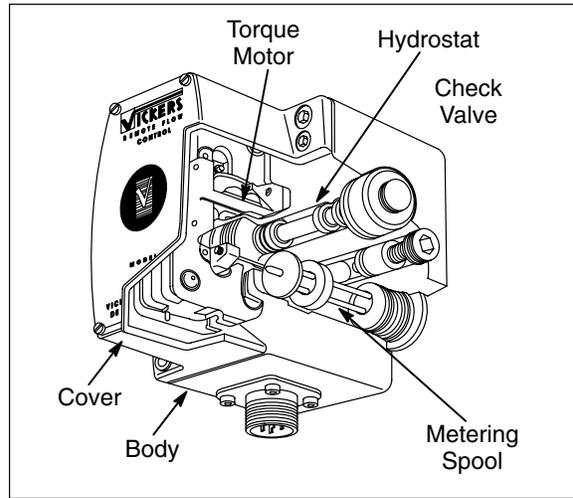


Figure 1. Cutaway view of FCGT-02-\*-\*-11

# Section III – Principles of Operation

## A. Spool Adjustment

The metering spool is adjusted at the factory for a minimum flow of 5 in<sup>3</sup>/ minute, ("A" Models), and 50 in<sup>3</sup>/ minute for "B" models.

## B. Theory Of Operation

Consider the FCGT Flow Control Valve as being two distinct and separate systems – one a standard compensated flow control with a fixed throttle setting and secondly an electrically modulated device (torque motor), used to vary the throttle opening. (Refer to the pictorial diagram Figure 2, during the following explanation.)

**Flow Controls** – Flow controls work on the principle that flow through an orifice will be constant when the pressure drop across the orifice is held constant. Flow (Q) through an orifice is directly proportional to the orifice area (A) and the square root of the pressure drop across it ( $\sqrt{\Delta P}$ ).

$$Q = A \sqrt{\Delta P / 0.0325} \quad Q = USgpm \quad A = in^2$$

Valid for short orifice      $\Delta P$  – PSI drop across orifice

Assume throttle orifice "A" (the metering spool orifice) is opened to allow 200 cubic inches / minute, (in<sup>3</sup> / minute), flow through the valve to an external load circuit. The external load circuit develops 1000 PSI. Inlet pressure to the valve is 2000 PSI.

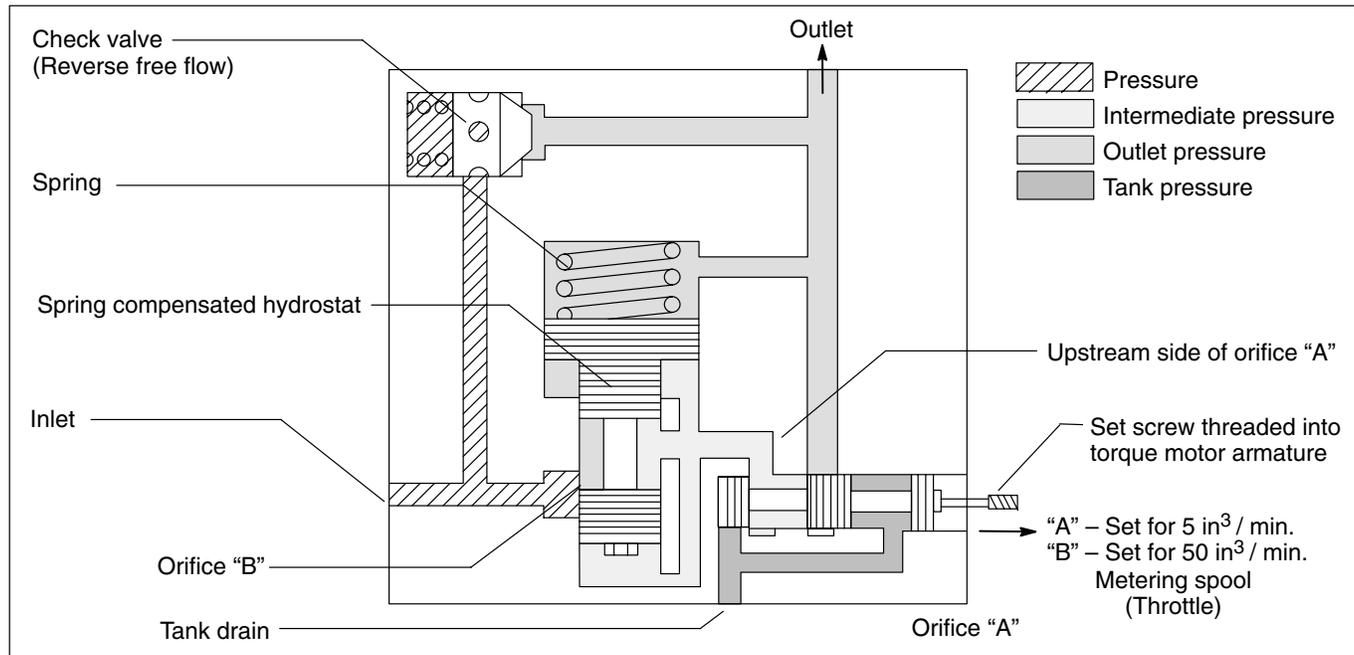


Figure 2. Pictorial Diagram

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The total pressure drop across the valves two series orifices “A” and “B” must equal 1000 PSI, (the difference between inlet and outlet pressures). The normal drop across orifice “A” is between 60 and 80 PSI. (Use 75 PSI for this explanation.) Orifice “B” will drop 925 PSI, the total of the two pressure drops is the difference between inlet and outlet pressures.

If the work load increases, the outlet pressure increases. To keep a constant flow, the pressure drop across orifice “A” must not change. This is accomplished as follows:

The increased outlet pressure is sensed against the spring end of the hydrostat, causing it to move down, increasing the area of orifice “B” and reducing the pressure drop across it. This increases the pressure available at the up–stream side of orifice “A”. 200 in<sup>3</sup>/minute will continue to flow as long as a 75 PSI pressure drop is maintained across orifice “A”.

If the work load were to decrease, (output PSI lower), a similar set of events will begin, except in the opposite direction. The hydrostat will move up. Orifice “B” reduces in size, increasing the pressure drop across it, lowering the pressure at the up–stream side of orifice “A” and a constant 200 in<sup>3</sup>/minute will continue to flow through the valve.

**Torque Motor** – A high force permanent magnet torque motor imparts linear motion to the torque motor armature. The deflection of the armature is directly proportional to current through the torque motor coils. This armature is linked to the metering spool with a wire and set screw. When current is applied to the torque motor coils, the armature is deflected to a certain position and the metering spool follows, opening or closing orifice “A”. When orifice “A” changes, the flow control will vary flow through the valve and hold it constant at the new setting of the metering spool regardless of workload.

## Section IV – Installation and Operating Instructions

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### A. Installation Drawings

The installation drawing listed in Table 1 will show installation dimensions and port locations.

### B. Mounting

The FCGT- 02-\* -11 Flow Control Valve is designed for manifold or subplate mounting. Refer to the installation drawing for subplate dimensions.

### C. Piping And Tubing

1. All pipes and tubing must be thoroughly cleaned before installation. Recommended methods of cleaning are sand blasting, wire brushing and pickling.

#### NOTE

For instructions on pickling, refer to instruction sheet 1221 – S.

2. To minimize flow resistance and the possibility of leakage, only as many fittings and connections as are necessary for proper installation should be used.

3. The number of bends in tubing should be kept to a minimum to prevent excessive turbulence and friction of oil flow. Tubing must not be bent too sharply. The recommended radius for bends is three times the outside diameter of the tube.

### D. Hydraulic Fluid Recommendations

Oil in a hydraulic system performs the dual function of lubrication and transmission of power. It constitutes a vital factor in a hydraulic system, and careful selection should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components with particular emphasis on hydraulic valves.

Data sheet I-286-S for oil selection is available from Vickers Technical Publications, Troy, MI 48007-0302.

Oil recommendations noted in the data sheet are based on our experience in industry as a hydraulic component manufacturer.

Where special considerations indicate a need to depart from the recommended oils or operating conditions, see your Vickers representative.

#### Cleanliness

Thorough precautions should always be observed to insure the hydraulic system is clean.

1. Clean (flush) entire new system to remove paint, metal chips, welding shot, etc.
2. Filter each change of oil to prevent introduction of contaminants into the system.
3. Provide continuous oil filtration to remove sludge, and products of wear and corrosion generated during the life of the system.
4. Provide continuous protection of system from entry of airborne contamination, by sealing the system and/or by proper filtration of the air.
5. During usage, proper oil filling and servicing of filters, breathers, reservoirs, etc., cannot be over emphasized.
6. Thorough precautions should be taken, by proper system and reservoir design, to insure that aeration of the oil will be kept to a minimum.

### E. Overload Protection

A relief valve is required to limit pressure in the system and to protect components from excessive pressure. The relief valve should be connected in the circuit at the outlet of the pump, before the FCGT flow control valve. The relief valve pressure setting should be adjusted just above the minimum work requirements of the system. DO NOT exceed the pressure rating of any system component or a malfunction may result.

# Section V – Service and Maintenance

## A. Inspection

Periodic inspection of the fluid condition and tube or piping connections can save time-consuming breakdowns and unnecessary parts replacement. The following should be checked regularly.

1. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the fluid to leak out. If the fluid level becomes so low as to uncover the inlet pipe opening in the reservoir, extensive damage to system components can result. In suction or return lines, loose connections permit air to be drawn into the system resulting in noisy and/or erratic operation.

2. Clean fluid is the best insurance for long service life. Therefore, the reservoir should be checked periodically for dirt or other contaminants.

If fluid becomes contaminated, the system should be drained and the reservoir cleaned before new fluid is added.

3. Air bubbles in the reservoir can ruin system components. If bubbles are seen, locate the source of the air and seal the leak.

## B. Adding Fluid To The System

When hydraulic fluid is added to replenish the system, it should be pumped through a 10 micro (absolute) filter.

It is important that the fluid be clean and free of any substance which could cause improper operation or wear.

## C. Adjustments

See Test Procedure – Section VII.

## D. Lubrication

Internal lubrication is provided by the fluid in the system.

## E. Replacement Parts

Reliable operation through the specified operating range is assured only if genuine Vickers parts are used.

Sophisticated design processes and materials are used in the manufacture of our parts. Substitutions may result in early failure. Part numbers are shown in the parts listing – reference Figure 3.

## F. Product Life

The longevity of these products is dependent upon environment, duty cycle, operating parameters and system cleanliness. Since these parameters vary from application to application, the ultimate user must determine and establish the periodic maintenance required to maximize life and detect potential component failure.

## G. Troubleshooting

Table 3 lists the common difficulties experienced with FCGT electrically modulated flow control valves. It also indicates probable causes and remedies for each of the troubles listed.

TROUBLE	PROBABLE CAUSE	REMEDY
External leakage	Back pressure in drain line and/or defective seals.	Drain directly to reservoir. Replace seals.
Stiction	Contamination and/or metering spool misalignment. Insufficient dither.	Clean valve. See alignment noted in test procedure Section VII.
Feed rate variations	Hydrostatic pressure compensator inoperative and/or sticking hydrostat.	Clean valve and flush system. Polish hydrostat and metering spool or replace with new parts.
Maximum flow not obtainable	Contaminants in throttling orifice. Metering spool binding and not shifting fully or insufficient voltage to torque motor.	Clean valve. Check torque motor coils and input current. Realignment may be necessary. If this does not correct trouble, valve should be returned to Vickers for overhaul.
Check valve inoperative	Dirt lodged between mating faces, or finish faces scored.	Disassemble and flush thoroughly. Check filter element. Filter bypass may be open.

Table 3. Troubleshooting Chart

# Section VI – Overhaul

## A. General



### CAUTION

*Before breaking a circuit connection, make certain that power is off and system pressure has been released. Lower all vertical cylinders, discharge accumulators, and block any load whose movement could generate pressure.*

Drain oil from the hydraulic system. Use new, clean, filtered oil when restoring the unit to service. Clean the outside of the unit thoroughly to prevent entry of dirt into the system. After removing the valve and before disassembly, cap or plug all ports and disconnected hydraulic lines.



### CAUTION

*Absolute cleanliness is essential when working on a hydraulic system. Always work in a clean area. The presence of dirt and foreign materials in the system can result in serious damage or inadequate operation.*

## B. Special Tools

The following special tools are required:

1. Test stand mounting plate model FGTM – 02 – 10 subplate and one BKFCGT – 02 – 644 bolt kit.
2. Power supply rated at: Input 115 AC 50/60 Hz, Output 0 – 300 DC mA. Vickers EMCS – P – 30 power supply part number 631995.
3. Millimeter rated at 0 – 500 mA.
4. Test stand capable of providing the required hydraulic flow. See figure 6 located in Section VII, Test Procedure.
5. Pencil type solder iron and rosin core solder.
6. Volt – Ohm meter (VOM).
7. 5 inch “C” clamp.

## C. Improved Tools

No improvised tools are required for overhaul.

## D. Disassembly

Periodic maintenance of the valve will generally not require disassembly to the extent described here. However, the sequence can also be used as a guide for partial disassembly. In general, disassembly is accomplished in the item number sequence shown in figure 3. Special procedures are included in the following steps:

### NOTE

Discard and replace all “O” rings removed during disassembly.

1. Prepare a clean lint free surface on which to lay internal parts of the valve.

2. Remove and discard “O” rings (1) and (2).

3. Remove four screws (3) from the electrical connector (4) and allow the connector to hang down on its wires.

4. Symbolize each wire with a piece of tape to allow reassembly to the same pin of the connector. Unsolder the four wires from connector (4). Remove connector and gasket (5).

### NOTE

Hold the valve over a container during the following step. The cover is full of system fluid that can leak out during cover removal.

5. Remove four screws (6) and cover (7). This exposes torque motor assembly (10). Use a 0.05 inch hex key to thread metering spool adjustment screw from the torque motor armature nut.

6. Remove four screws (8) and washers (9) from torque motor assembly (10) and remove torque motor from valve body (30). Set the torque motor on the clean prepared surface. Remove metering spool (12) from body (30). Be careful not to stress or bend the wire. Lift spacer (11) and gasket (13) from valve. Discard gasket.

### NOTE

Parts (14) and (15) are used only on FCGT-02-A-\*\*\*-11 models. Do not remove from body of valve at this time.

7. Apply pressure to center of retainer (17) with a “C” clamp and remove snap ring (16) with a sharp screwdriver.

8. Remove parts (17) through (20) from valve body (30).

9. Apply pressure to center of retainer (22) and remove snap ring (21) with a sharp screwdriver.

10. Remove retainer (22) then separate “O” ring (23) from retainer. Discard “O” ring.

11. Remove parts (24) through (26). DO NOT remove seat (27) at this time.

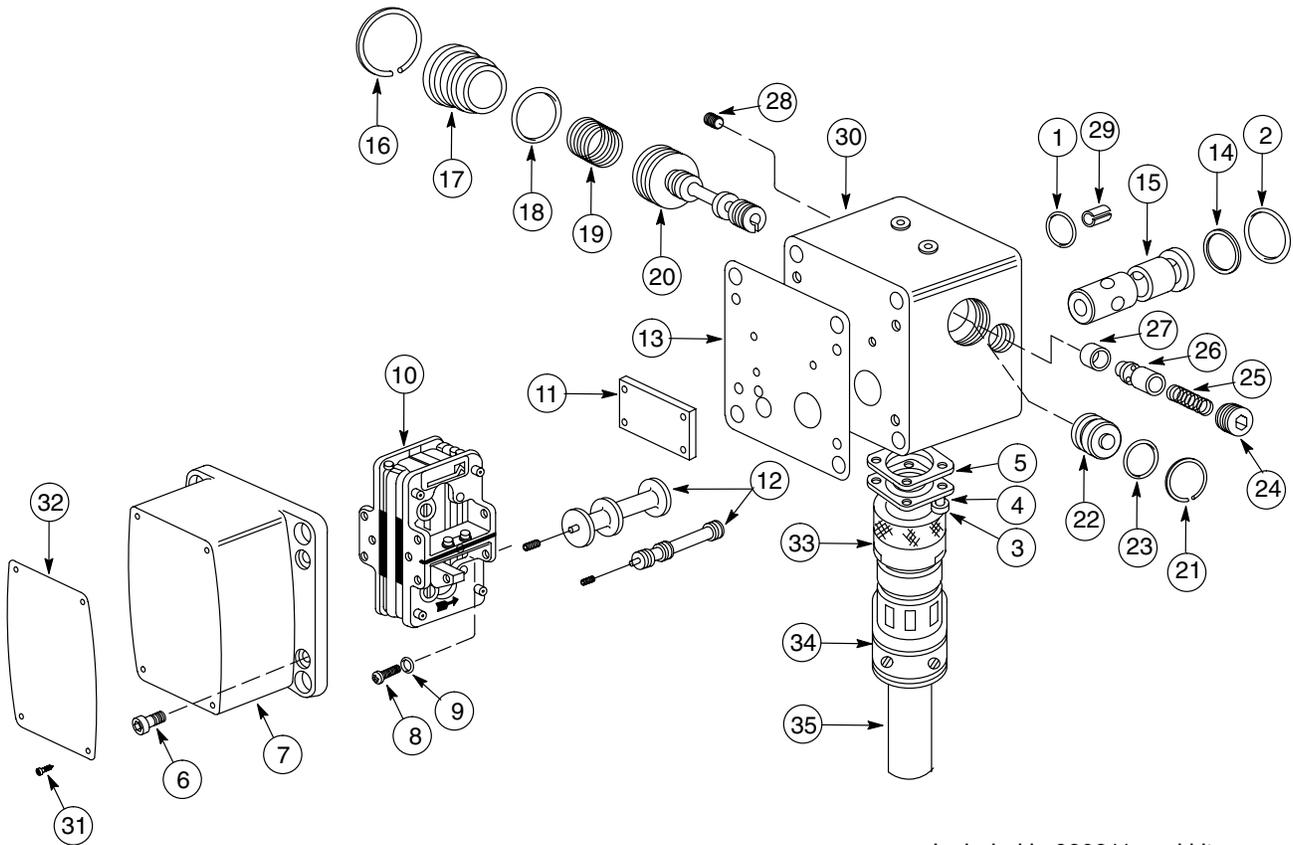
## E. Inspection, Repair & Replacement

### NOTE

All parts must be thoroughly cleaned and kept clean during inspection and assembly. The close tolerance of the parts makes this requirement very important. Clean all removed parts, using a commercial solvent that is compatible with the system fluid. Compressed air may be used in cleaning, but it must be filtered to remove water and contamination. Clean compressed air is particularly useful in cleaning the spool and body passages. Replace all parts that do not meet the following specifications.

1. Inspect all components for excessive wear, erosion and/or seizure.

2. Inspect torque motor (10) for contaminations (Ferrous wear particles binding the armature). Inspect torque motor coils for continuity (use the volt – ohm meter). Replace the torque motor if contaminated, or coils are open. DO NOT attempt repair of the torque motor.



▲ Included in 920211 seal kit.  
 -S30 Equivalent seal kit 920235

Figure 3. Exploded View

Description	Source code
FCGT-02-A-004-11-(S30)	A
FCGT-02-A-028-11-(S30)	B
FCGT-02-A-220-11-(S30)	C
FCGT-02-A-530-11-(S30)	D
FCGT-02-B-004-11-(S30)	E
FCGT-02-B-028-11-(S30)	F
FCGT-02-B-220-11-(S30)	G
FCGT-02-B-530-11-(S30)	H

**NOTE**  
 When Usable On Code is blank, the part is used on all models tabulated in source code. When Usable On Codes are listed, use with indicated models only.

Index No.	Part No.	Description	Qty.	Usable On Code	Index No.	Part No.	Description	Qty.	Usable On Code
1	▲ 154011	"O" Ring	2		16	233625	Retaining Ring	1	
2	▲ 166772	"O" Ring	1		17	234939	Retainer	1	
3	179263	Screw	4		18	▲ 166772	"O" Ring	1	
4	243233	Elect. Connector	1		19	234964	Spring	1	
5	▲ 235068	Gasket	1		20	224342	Hydrostat	1	
6	7889	Screw	4		21	312383	Retaining Ring	1	
7	234484	Cover	1		22	317922	Retainer	1	
8	125792	Screw	4		23	▲ 153950	"O" Ring	1	
9	176021	Lockwasher	4	BF	24	7076	Plug	1	
10	207961	Torque Mtr. (280 Ohms)	1	CG	25	95633	Spring	1	
	207692	Torque Mtr. (2200 Ohms)	1	DH	26	79795	Check Valve	1	
	211458	Torque Mtr. (5300 Ohms)	1	AE	27	239034	Seat	1	
	212619	Torque Mtr. (40 Ohms)	1		28	7074	Plug (Aux. Drain port)	1	
11	234483	Spacer	1	EFGH	29	160571	Pin	1	
12	234485	Spool wire & screw S/A	1	ABCD	30	328055	Body	1	
	238129	Spool wire & screw S/A	1		31	416834	Rivet	4	
13	▲ 234478	Gasket	1	ABCD	32	247278	Nameplate	1	
14	192435	Washer	1	ABCD	33	242123	Connector	1	
15	238127	Sleeve	1		34	126058	Clamp	1	
					35	595310	Adapter	1	

3. Inspect metering spool (12) and hydrostat (20) for excessive wear, galling, erosion, and burrs. Remove burrs with an India stone. If either of the spools are defective, check body (30) bores for similar defects. Replace defective parts.

4. Inspect check valve (26) for excessive wear, erosion and burrs. The seat contact area of the valve should have a bright circular contact area. Leakage paths across the check valve will show up as a break in the bright circular area. Erosion of the seat area may also cause a leakage path to develop. If seat (27) requires removal, tap seat with an appropriate thread, then install a length of threaded drill rod into the seat. Remove seat from the valve body. See Figure 4.

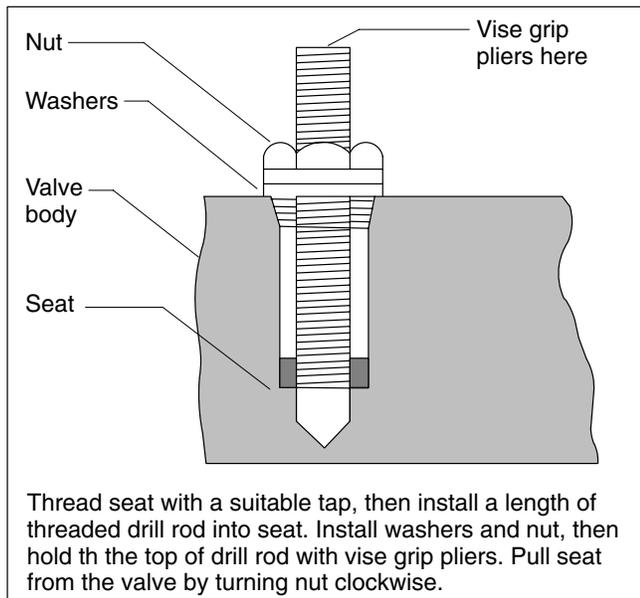


Figure 4. Removal of seat

5. Inspect springs (19) and (25) for excessive wear and damaged coils. Replace springs if coils are damaged. Inspect springs for distortion. The ends of each spring must be parallel to each other. Replace springs if distorted.

6. Inspect body (30) for burrs, nicks, plugged passages and porosity. If either the metering spool, hydrostat or check valve are to be replaced, thoroughly inspect the bore from which the part was removed for defects. If the metering spool requires replacement, and the unit is a FCGT-02-A-11, remove and replace sleeve (15) before installation of the new spool. Clean up sleeve with an India stone before the spool is installed to remove the possibility of the existance of burrs. Burrs can prevent the sleeve from entering the body and/or the metering spool from moving free within the sleeve. A very close slip fit exists between the body and sleeve. (0.0009 – 0.0012 inch). DO NOT force at assembly. If a problem exists, cool the sleeve before installation into the body. This reduces the diameter of the sleeve and will facilitate installation.

7. Inspect electrical connector (4) for solder splashes between pins, cross threads and broken pins. Replace if defective.

## F. Assembly

Replace the gaskets and “O” rings removed from the unit with those supplied in the seal kit. Lubricate “O” rings and parts using clean system fluid to facilitate assembly. Assemble parts in the reverse numerical sequence. Special procedures are included in the following steps: (See Figure 3).

1. If nameplate (32) was removed, install a new nameplate with four screws (31).

2. Install parts (29) through (24) into body (30). If seat (27) or check valve (26) were defective, replace the check valve and seat as follows:

a. Press a new seat into the body (chamfer end of O.D. inward). Press seat in until it bottoms against the shoulder. Clean bore before installation of check valve to remove debris left from the seat installation.

b. Install a new check valve (26). The new check valve must be seated (matched to the seat) to prevent leakage. To seat a valve, first install valve into body without the spring. Insert a brass rod (smaller than the spring) behind the valve. Give the rod a sharp tap with a small hammer. This will seat the valve within the body. Remove the brass rod and valve. You will notice a circular pattern at the seat contact area of the valve. This pattern must not be broken or the valve will leak when put into service. Repeat the seating operation if required. Lubricate and assemble valve (26), then install spring (25) and plug together. Torque plug to 75–85 lb. in.

### NOTE

In the following step, hydrostat (20) must be installed with notch in small end parallel to mounting face of valve and pointing toward the electrical connector side of the valve body.

3. Install parts (23) through (16). Be careful not to cut “O” rings during installation. Press plug (17) fully in with a large “C” clamp. This will facilitate assembly of retaining ring (16).

4. Position body (30) with mounting face down on the workbench. Lay gasket (13) and spacer (11) in position on the body. Lubricate and install metering spool (12) into body(30).

5. Position torque motor (10) against body (30), (wires to be located in wiring hole of body). Thread four screws (8) with lockwashers (9) through torque motor, spacer and gasket into body. DO NOT secure screws at this time.

6. Position torque motor armature above the metering spool adjustment screw. With a 0.05 inch hex head tool, thread the adjustment screw into the torque motor armature nut. (Alignment of the metering spool will be required along with the alignment of the torque motor during test.)

Pull the symbolized wires through the electrical connector opening as far as possible. If the torque motor was replaced, check the symbolization on the old motor to determine correct electrical connections. Refer to Table 4 and Figure 5 if no connection information is available. Figure 5 will also help you determine the correct wiring for the different types of control systems used with torque motors. Table 5 defines the input current required for a maximum armature deflection of 0.020 inch.

Torque Motor Coil Location	Color Code Versus Connector Pin	
	Red	Coded
Coil "A"	A	B
Coil "B"	D	C
Coil located next to the armature connection nut		

Table 4. Coil location and wiring code to male electrical connector (Item 4, Figure 3).

7. Remove a 1/4 inch of insulation from the ends of the wires, then install a short piece of spaghetti sleeve over each wire end and slide back on the wire. Position the wire ends up and slide a new gasket (5) over the wires. Tin each wire end with solder, then insert wires one at a time into the proper pin of connector (4) and solder. Slide the sleeve over the pin after solder has cooled.

Coil resistance, ohms/wire code	Series aiding	Parallel	Differential
40 / Yellow	150 ma	300 ma	N/A
280 / White	50 ma	100 ma	100 ma
2200 / Blue	20 ma	40 ma	40 ma
5300 / Black	12.5 ma	25 ma	25 ma

Table 5. Input current required for max. armature deflection of 0.020 inch.

8. Assemble connector to the body with four screws. (3).

**NOTE**

Cover (7), screws (8), and washers (9) will be installed following test and calibration, Section VII.

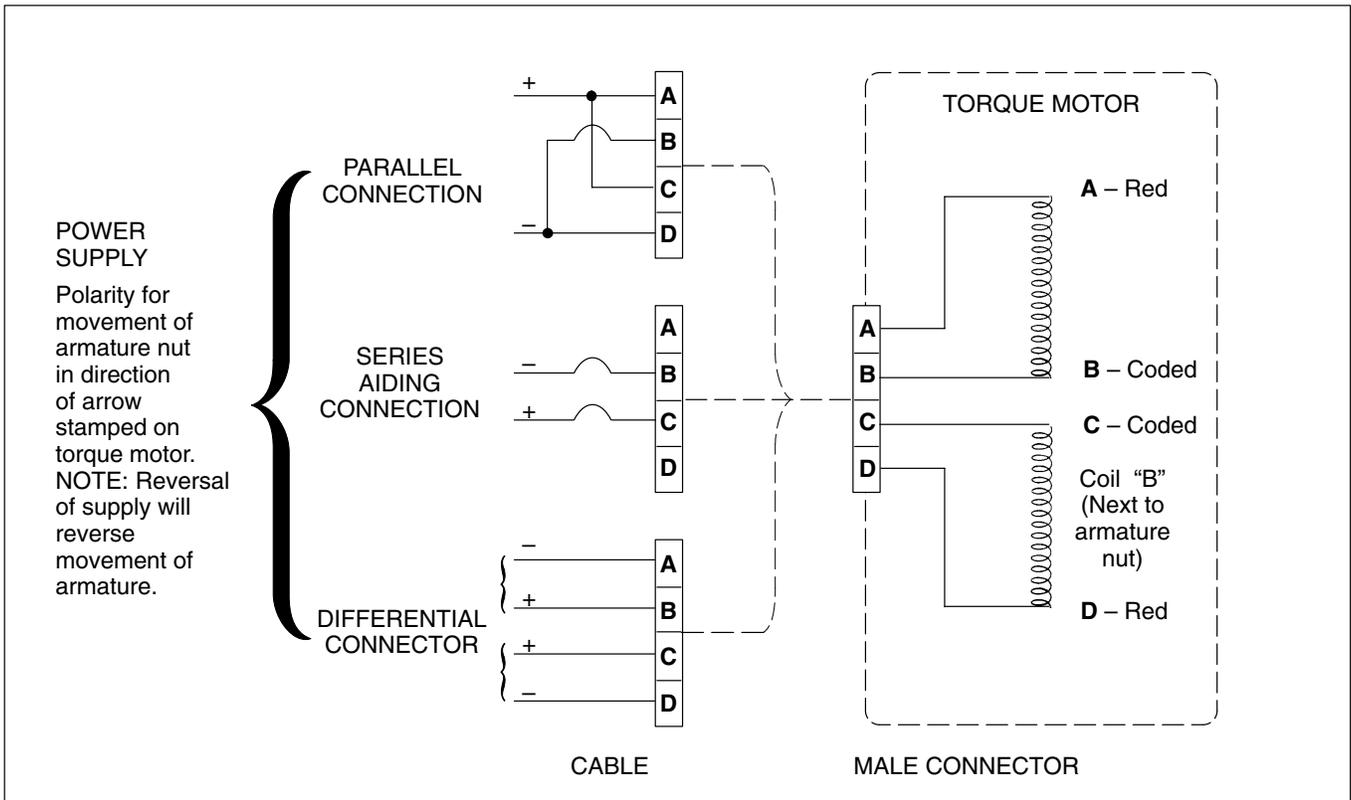


Figure 5. Schematic diagram of possible wiring connections to a Torque Motor.

# Section VII – Test Procedure

## A. Test Conditions

### Hydraulic

Fluid Medium: Oil viscosity grades: 150–315 SUS (32–68 cSt) @ 100° F (38°C)  
 Running: 70–250 SUS (13–54 cSt).  
 At start-up: 1000 SUS (220 cSt).  
 Maximum

Fluid Temperature: 115° –125°F

Flow Range: FCGT-02-A-11 5 – 250 cu. in. / min.  
 FCGT-02-B-11 50 – 1000 cu. in. / min.

Operating Pressure: 3000 PSI  
 (Maximum)

Reverse Free Flow: 1400 cu. in. / min.  
 (Maximum)

Differential Operating Pressure: 150 PSI

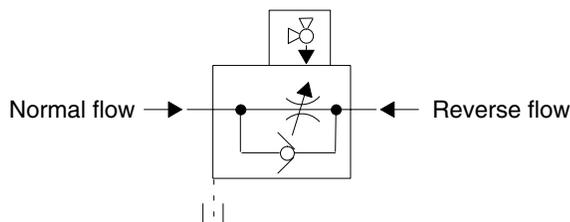
Power Supply (Recommended for two 40 Ohm coils connected parallel). See installation drawing 521555: EMCS–P–30 Assembly 631995

Hysteresis (With recommended power supply):  
 4% of max. current without dither.  
 2% of max. current with 45 mA (rms) dither.

Dither (optimum performance):  
 45 mA (rms) @ 60 Hz.

Subplate: FGTM–02–10 (Assy. 251168)

Bolt Kit: BKFCGT–02–644 (Bolts must be grade 7 or better).



Standard Graphic Symbol for Fluid Power Diagrams

## B. Test

### NOTE

A sample hydraulic circuit is shown in Figure 6. Modify an existing test stand or obtain the necessary components to assemble the test circuit.

1. Connect subplate FGTM-02-10 (Assembly 251168) to the test stand and mount the FCGT-02 with bolt kit BKFCGT-02-644.

2. Refer to sample test circuit Figure 6 during the following steps:

a. Close globe valves (6) and (15).

b. Open globe valves (1) and (12). (Vent to facilitate priming and load relief valve (11).

c. Energize hydraulic system. After system has primed, alternately adjust test relief valve (2) while closing globe valve (1) until 3000 PSI is read on gage (5) and globe valve (1) is completely closed.

d. Open globe valve (6).

### NOTE

Valve may be unstable until all air is purged from the system. Allow at least one minute for valve to stabilize before adjusting the metering spool.

e. Adjust metering spool (12 Figure 3) for zero flow. Use a 0.05 inch hex key.

f. Open globe valve (15) and adjust metering spool (12) to the minimum flow condition noted in Table 6. Use a beaker to measure the minimum flow.

Model	Minimum flow
FCGT-02-A-***-11	5 cu. in. / min. (81.9 cu. cm. / min.)
FCGT-02-B-***-11	50 cu. in. / min. (819.35 cu. cm. / min.)

Table 6. Minimum Flow Adjustment.

3. Turn off hydraulics and remove valve from the test stand. Place on the work bench with torque motor (10) up. Slightly loosen screws (8) that hold torque motor (10).

4. Connect power supply (9, figure 6) to valve. Observe polarity shown in figure 5. If millimeter reads in reverse, reverse its connections.

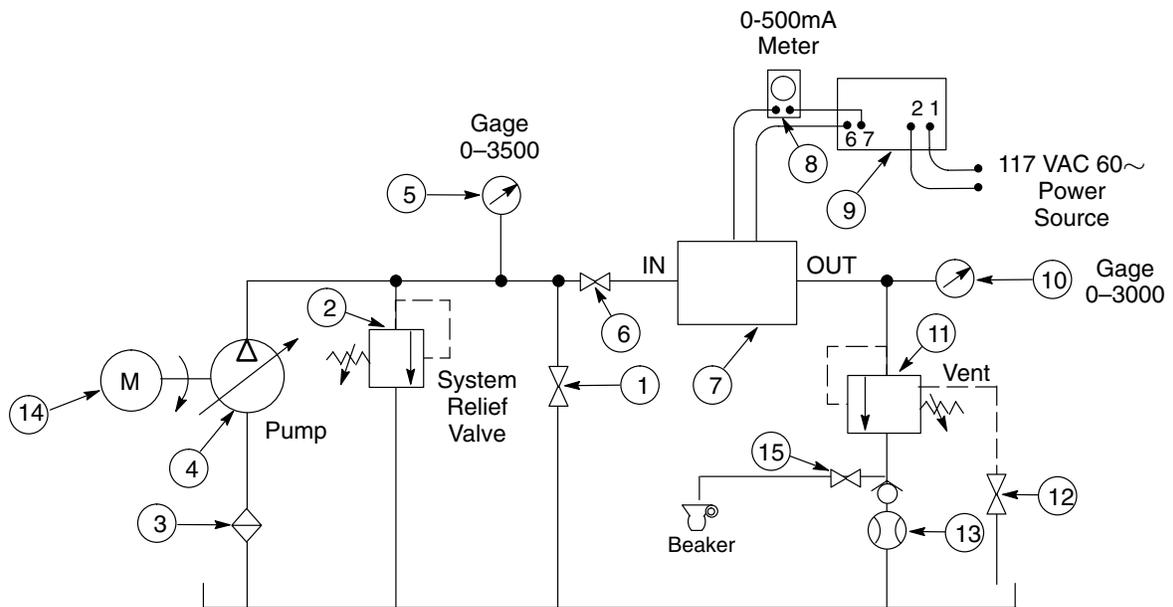
5. Set dither control high enough to feel a vibration at the torque motor armature. position the torque motor for maximum dither as felt at the torque motor armature nut, then tighten the torque motor mounting screws to 30 lb. in. Dither must still be felt at the torque motor armature.

6. Apply full signal (300 mA for two 40 Ohm coils in parallel) to the torque motor and return to zero current. Dither must be felt throughout the entire cycle. If dither fades, repeat steps (5) and (6).

Refer to Figure 5 for correct full signal current if coils are other than noted.

7. Recalibrate minimum flow, perform steps (1) and (2).

8. Install cover (7). Secure with screws (8) and lock-washers (9). Check valve performance with power supply. Remove valve from the test stand.



- |                               |   |  |
|-------------------------------|---|--|
| 1. Globe valve                | 8. Ammeter (0–500 mA)   | 12. Globe valve  |
| 2. Test stand relief valve    | 9. Power supply Vickers 631995 or equivalent. Must be capable of delivering 0–300 mA DC to a 20 OHM inductive load. | 13. Flow meter   |
| 3. Inlet filter               |   | 14. Electric drive motor approximately 10 hp for 5 gpm @3000 psi |
| 4. Variable delivery pump     |   | 15. $\frac{1}{2}$ " Globe valve                                  |
| 5. Pressure gage (0–3500 psi) |   | 16. 35 psi check valve   |
| 6. Globe valve                | 10. Pressure gage (0–3000 psi)  |  |
| 7. Valve under test           | 11. Load relief valve   |  |

Figure 6. Test stand for FCVT-02-\*11 valve