

MCS-SERVO INC.

1950A, BOUL. MARIE-VICTORIN, ST-BRUNO-DE-MONTARVILLE, QUÉBEC. J3V 6B9 • TÉL: (450) 653-9465 / FAX: (450) 441-2527 • www.mcs-servo.com

Friday, March 16th 2001

McGill University

Department of Biomedical Engineering
3775, University Street, Room 309
Montreal, Qc
H3A 2B4

To the attention of : Mr. Hank Leung and Mr. Robert E. Kearney, Ph.D., Eng.

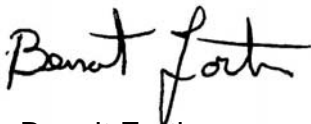
Reference : Quotation for rotary actuator revision #6

Messrs. Leung and Kearney,

As you requested, we revised the hydraulic power unit capacity according to the new data you transmitted to us.

If you have any questions, please do not hesitate to contact us.

Please, Mr. Leung, receive our best regards.



Benoit Fortin, eng.

MCS-Servo Inc.

Cc : Peter Hachey, technical representative

Rotary actuator assembly:

The rotary actuator should meet the following requirements:

Supply pressure of 3000 PSI.
Max. torque 3100 in-lbs.
Max. velocity 20 rad/sec.
Max. of 50 cycles per second.
Rotation of 12 degrees (+6 deg to -6 deg.)

The rotary actuator assembly includes:

- One (1) rotary actuator 26R-2-1V-DE-IS-FT/FLG, foot mounting, double shafts.
- One (1) Moog servovalve 72 high response series.
- One (1) 4 way / 2 position directional valve with roller to block supply pressure to the servovalve if it is activated (safety valve).
- One (1) manifold mounted on the actuator with SAE-16 ports to accept the servovalve and the safety valve.
- One (1) servovalve mating connector.
- One (1) machined coupling installed on one end to activate the safety valve if the rotation is higher than +/- 20 degrees .
- One (1) rotary potentiometer used as feedback.
- One (1) 0-5000 PSI gauge 2.5" dia., 1/4" NPT port, bottom connection.

The assembly will be flushed and tested at our facility. At 3000 PSI, the assembly can work for a period of 3 hours maximum to increase the actuator's life. Mechanical and electrical installation are not included. The coupling between the actuator and the machine is not included.

The existing installation has no drain line. The actuators' casing will not be drained to add significant life to shaft seals.

MCS-Servo Inc. will not be responsible for wounds caused by a malfunction of the hydraulic, mechanical or electronic system. The guarantee applies only for the replacement of the defective component for the duration of the guarantee.

Price for two rotary actuators assemblies with potentiometers: \$44100,00 net

Hydraulic power unit:

As we discussed, the two new actuator assemblies will operate at the same time. The existing actuator will not be in operation during this time. Each new actuator needs at least 8 GPM to reach the average velocity of 10 rad/sec. The servovalves should work at 3000 PSI to allow a sufficient amount of flow. With an 85% efficiency factor, 33 HP are required.

The hydraulic power unit includes:

- One (1) 100 Gallon reservoir with access door.
- One (1) 40 HP electric motor, 1800 RPM, 600 Volts, 3 phases, 60 Hz, Totally Enclosed Fan Cooled, C flange.
- One (1) 21 GPM Rexroth pump, variable flow, pressure compensated, adjusted at 3000 PSI and approximately 16 GPM.
- One (1) accumulator manifold consisting of a relief valve, check valve, electric dump valve and pressure test points.
- One (1) gauge 0-4000 PSI with gauge adaptor.
- One (1) breather with 3 μ element.
- One (1) visual oil level gauge.
- One (1) electric level gauge to stop the system in case of too low oil level into the reservoir.
- One (1) oil / water cooler.
- One (1) thermostatic valve to allow water in the cooler in case of high oil temperature.
- One (1) adjustable electric temperature switch to stop the system in case of too high oil temperature.
- One (1) high pressure filter, 3 μ \geq 200, without by-pass, with visual indicator.
- One (1) return filter, 3 μ \geq 200, with by-pass and visual indicator.
- All the necessary equipment to ensure the proper system function.

The hydraulic power unit will be assembled, flushed and tested at our facilities. The existing ¼ gallon accumulator will be recovered from the existing unit. The mechanical and electrical installations are not included. The water piping for the new oil / water cooler will have to be carried out by the customer. Hydraulic oil and nitrogen are not included.

Price for the hydraulic power unit:

\$16500,00 net

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Installation and flushing:

The installation includes all the required material to connect the two rotary actuator assemblies and the new hydraulic power unit on the existing hydraulic piping. The price includes two 1" ball valves (for pressure and return lines). Tubing with 37deg. flare will be used. A distance of 20 feet is allowed between the existing tubing and the rotary actuators. For longer rotary actuator shaft seal's life, the drain port should be used. We plan to connect the actuator's drain to the return line.

All the existing and new piping will be flushed. All new hoses will be Aeroquip brand, 3000 PSI working pressure, 4 braids. They will be pressure tested at 1.5 times the operating pressure. A test certificate will be given to you.

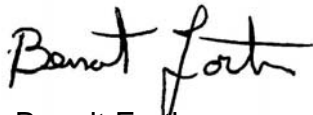
Labour and meals are not included in the price. See our hourly rates in annexe A.

Price for the material required for installation and flushing: \$3250,00 net

Terms and delivery :

Guarantee :12 months
Quotation :valid for 30 days
F.O.B. :St-Bruno-de-Montarville
delivery :10 to 12 weeks for rotary actuator assemblies
 6 weeks for hydraulic power unit
Price :Canadian Dollars
Terms :net 30 days

Applicable taxes are not included.



Benoit Fortin, eng.

MCS-Servo Inc.

Annexe A : MCS-SERVO's Hourly rates

- Regular hours:
 - ◆ 75,00 \$ / hour (technician)
 - ◆ 95,00 \$ / hour (engineer)

- Overtime (after 8 regular hours or Saturday) :
 - ◆ 112,50 \$ / hour (technician)
 - ◆ 142,50 \$ / hour (engineer)

- Overtime (Sunday and Holidays) :
 - ◆ 150,00 \$ / hour (technician)
 - ◆ 190,00 \$ / hour (engineer)

- Mileage : 0,47 \$ / Km

- Travelling time : 45,00 \$ / person / hour

Meals and expenses (hotel, etc...): upon invoicing