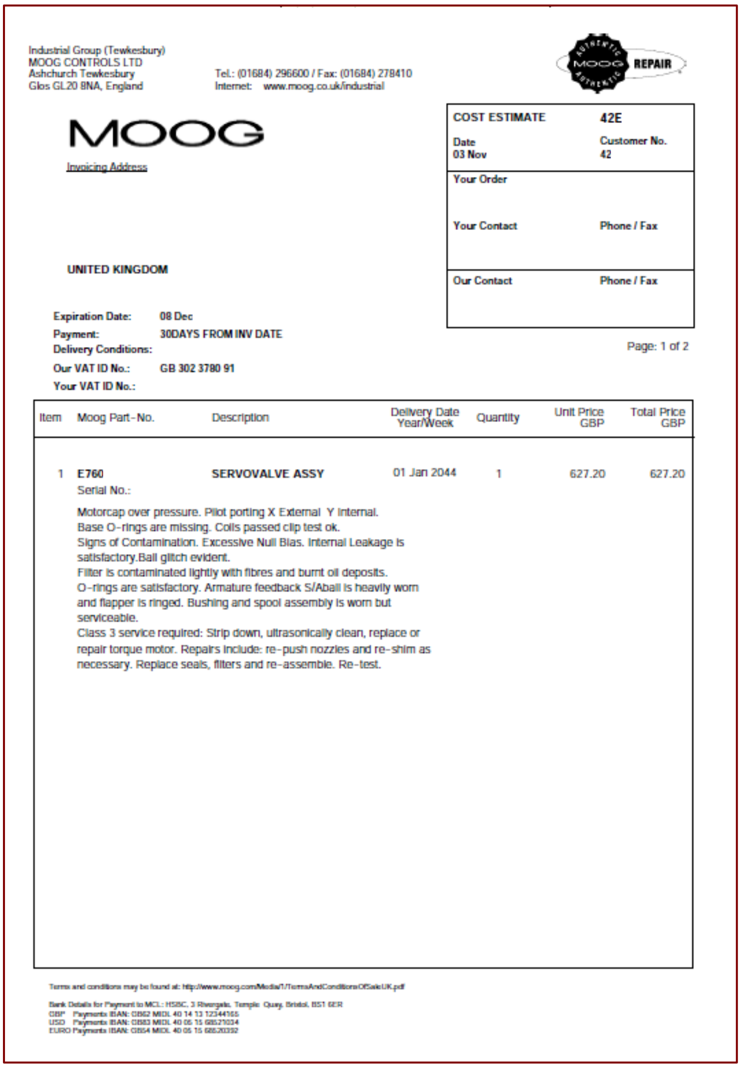
Moog Servovalve Service

Understanding your Repair Quotation



Industrial Group (Tewkesbury)
MOOG CONTROLS LTD
Ashchurch Tewkesbury
Glos GL20 8NA, England

Tel.: (01684) 296600 / Fax: (01684) 278410
Internet: www.moog.co.uk/industrial

AUTHENTIC MOOG REPAIR

MOOG

Invoicing Address

UNITED KINGDOM

COST ESTIMATE	**42E**
Date 03 Nov	**Customer No.** 42
Your Order	
Your Contact	**Phone / Fax**
Our Contact	**Phone / Fax**

Expiration Date: 08 Dec
Payment: 30DAYS FROM INV DATE
Delivery Conditions:
Our VAT ID No.: GB 302 3780 91
Your VAT ID No.:

Page: 1 of 2

Item	Moog Part-No.	Description	Delivery Date Year/Week	Quantity	Unit Price GBP	Total Price GBP
1	**E760**	**SERVOVALVE ASSY**	01 Jan 2044	1	627.20	627.20

Serial No.:

Motorcap over pressure. Pilot porting X External Y Internal.
Base O-rings are missing. Coils passed clip test ok.
Signs of Contamination. Excessive Null Bias. Internal Leakage is satisfactory.Ball glitch evident.
Filter is contaminated lightly with fibres and burnt oil deposits.
O-rings are satisfactory. Armature feedback S/Aball is heavily worn and flapper is ringed. Bushing and spool assembly is worn but serviceable.
Class 3 service required: Strip down, ultrasonically clean, replace or repair torque motor. Repairs include: re-push nozzles and re-shim as necessary. Replace seals, filters and re-assemble. Re-test.

Terms and conditions may be found at: http://www.moog.com/Media/1/TermsAndConditionsOfSaleUK.pdf

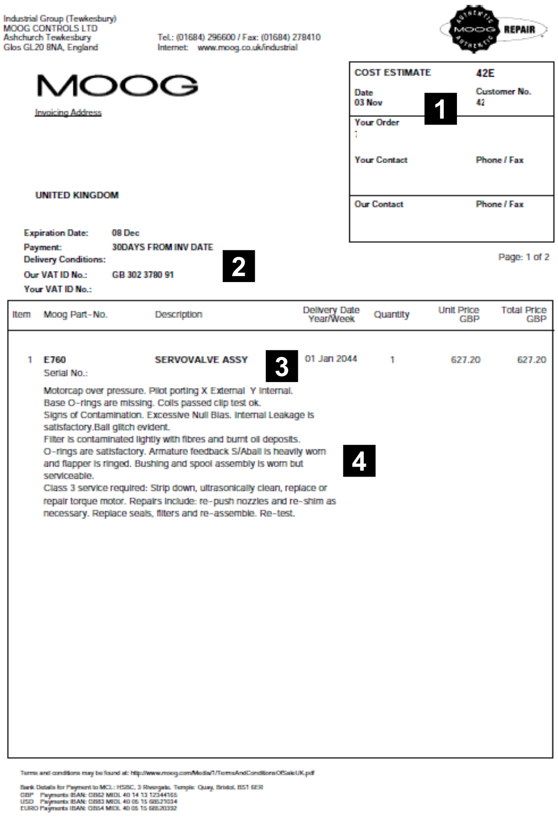
Bank Details for Payment to MCL: HSBC, 3 Rivergate, Temple Quay, Bristol, BS1 6ER
GBP Payments IBAN: GB62 MIDL 40 14 13 12344165
USD Payments IBAN: GB83 MIDL 40 05 15 68521034
EURO Payments IBAN: GB54 MIDL 40 05 15 68520392

Moog Servovalve Service

Understanding Your Repair Quotation

This document has been produced to enable you to easily interpret the test results supplied by our Service Team. Should you have any queries, please do not hesitate to contact the team. Details can be found at the back of this document.

Page 1 Explained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3

Serial No.:
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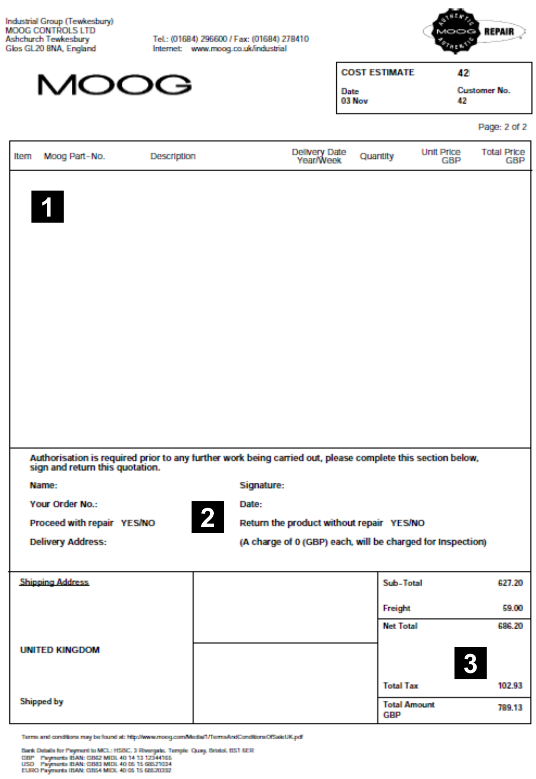
4

Section	Section Title	Description
1	Cost Estimate reference code and customer details	Used to identify the repair estimate. Shows reference, customer identification and internal administration contact information.
2	Estimate expiration date and payment terms	Details the expiry date of the estimate, customer's payment terms as defined by our business system, delivery conditions and our VAT number.
3	Repair Model Number and Estimate	Lists the model numbers being inspected. The delivery date on the report will usually read 01 Jan 2044. The actual date will be advised on receipt of the purchase order.
4	Description of inspection results and recommendations	Lists results and recommendations produced during our initial checks. Will also indicate the recommended class of service required to bring your product back within Moog specification or to customer specific requirements. Information regarding the terminology used in these descriptions can be found in the glossary of terms in the back of this document.

Page 2 Explained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COST ESTIMATE 42
Date 03 Nov
Customer No. 42

Page: 2 of 2

Item	Moog Part-No.	Description	Delivery Date Year/Week	Quantity	Unit Price GBP	Total Price GBP

1

Authorisation is required prior to any further work being carried out, please complete this section below, sign and return this quotation.
Name:
Signature:
Your Order No.:
Date:
Proceed with repair YES/NO
Return the product without repair YES/NO
Delivery Address:
(A charge of 0 (GBP) each, will be charged for inspection)
2

Shipping Address
UNITED KINGDOM
Shipped by

Sub-Total	627.20
Freight	59.00
Net Total	686.20
Total Tax	102.93
Total Amount GBP	789.13

3

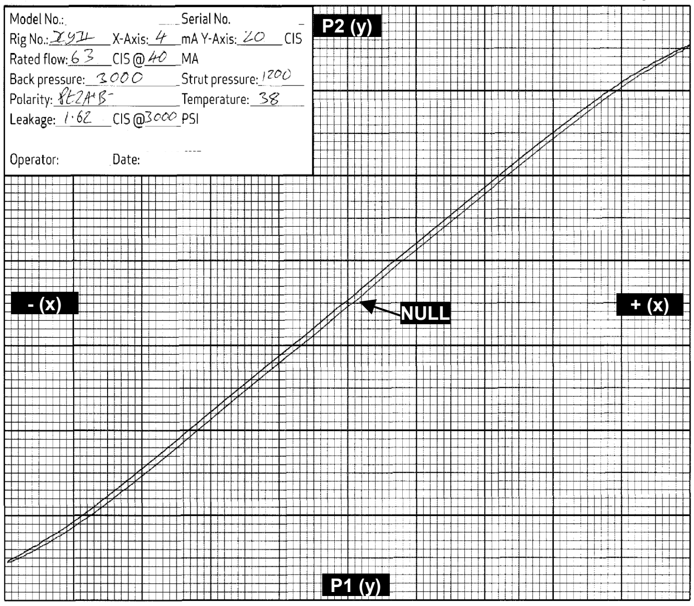
Section	Section Title	Description
1	Continuation of model numbers and inspection results	An additional area for larger orders requiring more space for model numbers and inspection results.
2	Authorisation Form	To be filled out by the customer, with the information required by Moog to process the order and authorise the repair, including purchase order number.
3	Estimate Summary	Shows the total cost including VAT, & Shipping for the entire estimate.

Moog Servovalve Service

Accompanying Documentation (on request)

Test plots many accompany your report to show the flow characteristics or leakage level within the servovalve. These reports can vary in appearance depending on the test rig used when your valve was inspected. The following pages give examples of test plots with a brief explanation of what is being.

Expanded Flow Plot *



An expanded flow plot is the most common type which accompanies test data. This plot shows your servovalve flow performance and indicates other characteristics including Hysteresis, lap condition, and null bias.

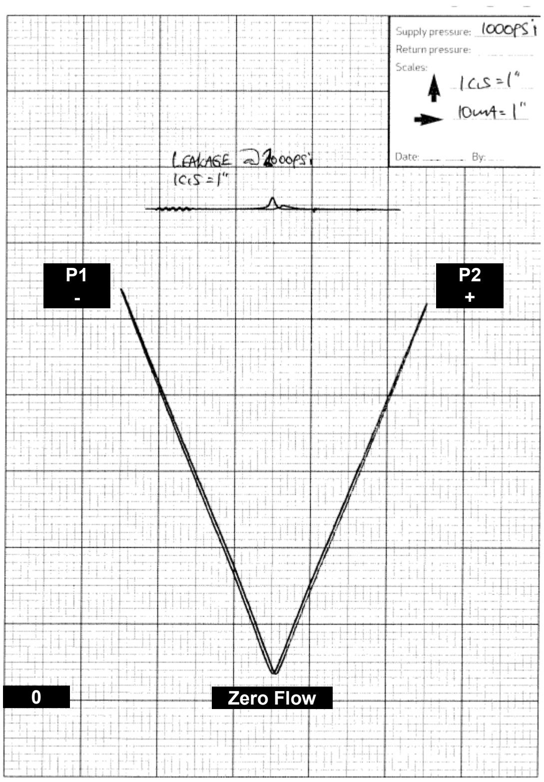
This measurement is obtained using a flow meter between the two service ports. During this test we exercise the servovalve to perform a full cycle starting at Null Position (Spool Centre).

A command signal is applied to cycle the servovalve to maximum positive, returning through the null point to the maximum negative, and returning back to null.

These plots may vary slightly in appearance depending on the characteristics of the servovalve under test.

These plots should be accompanied by a legend (see in the top left corner in this example), which will indicate the scaled unit of measure. In most circumstances, the x-axis plots the command signal , and the Y-axis plots the flow rate.

Return Flow Plot *



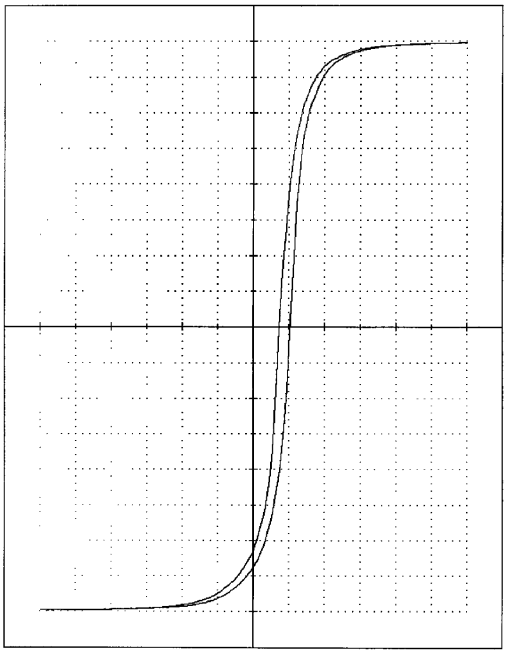
This type of plot differs from the usual expanded flow plot because the measurement of flow is taken in the return port.

Since the measurement is taken in the return port, the direction of flow in the service ports does not affect the plot as flow to the return port is always in the same direction and this is the reason why there is no negative portion on the plot. The test method is the same as explained previously in the expanded flow plot. The values measured with this technique will include the internal leakage, and this is the reason why the lowest value appears above zero flow.

The second plot above the V, shows the internal leakage levels of a servovalve. Leakage through null position (spool centre) will in most cases show a rise in leakage, and either side of the null region is referred to as Tare Leakage.

* It is quite common that the above two plots are separate.

Delta P Plot



The final example to the left is referred to as a Delta P plot. This plots the relationship between pressure drop across the valve and flow rate achieved. This plot does not always accompany all valve repair documentation.

About Contamination

70% to 80% of hydraulic system problems and failures can be attributed to contamination.

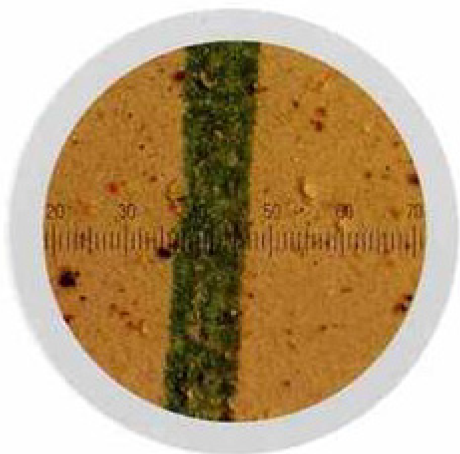
Sources of contamination

External – Contaminants enter the system from an external source. This could be through insufficient seals, inadequate air breathers, opening the reservoir lid or dirty oil being added to the system.

Internal – Contamination from within the system can be self-generated particles from components wearing in the system, or from breakdown of fluid itself.

Moog repair reports do not identify sources of contamination, or indicate contamination levels within your system. The only way to do this correctly is to have an oil sample from your system analysed under microscope by a trained and proficient person. Moog offer an oil sampling service, which includes testing for contamination, viscosity and water content of your oil.

It is very important the person responsible for maintenance of your system is aware of the effects of contamination, how to identify sources of contamination and the required cleanliness levels required for the components in your system.



Training to increase the uptime of your machinery

Moog in partnership with the NFPC offer courses on effective maintenance of hydraulic systems. For more information on our oil sampling service or our training courses please contact us.

Moog Servovalve Service

Contact Us

MOOG

Training Courses

Effective Maintenance Of Hydraulic Servo Systems

This course will concentrate on the necessary maintenance processes and procedures that must be in place to ensure the effective and continuous operation of servo valves.

Installing & Commissioning of Servovalves and Servo-Proportional Valves

This course is aimed at engineers who already have some experience in commissioning hydraulic equipment, but now need to improve their skills in order to work effectively, efficiently and safely with open-loop and closed-loop electro-hydraulic systems.

NFPC National Fluid Power Centre

for Fluid Power Motion Control Training

Moog Training Course Contacts

Mark Greenway
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Tel: 01684 278223

Caroline Sheppard
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Tel: 01684 278369

Our Service and Repair Team

If any information contained within the repair information you receive is unclear, please do not hesitate to contact one of our team listed below for further information.

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MOOG GLOBAL SUPPORT™

Moog Servovalve Service

Glossary of Terms

Electrical

Coil Impedance	The complex ratio of coil voltage to coil current. Coil impedance will vary with signal frequency, amplitude, and other operating conditions, but can be approximated by the dc coil resistance (R ohms) and the apparent coil inductance (L henrys) measured at a signal frequency.	**Polarity**	Distinction between positive and negative poles of the electrical signal.
Dither	An ac signal sometimes superimposed on the servovalve input to improve system resolution. Dither is expressed by the dither frequency (Hz) and the peak-to-peak dither current amplitude (ma).	**Rated Current**	The specified input of either polarity to produce rated flow, expressed in milliamperes (ma). Rated current is specified for a particular coil configuration (differential, series, individual or parallel coils) and does not include null bias current.
Input Current	The electrical current to the valve which commands control flow, expressed in milliamperes (ma).		

Hydraulic

Control Flow	QV - The flow through the valve control ports to the load expressed in in3/sec (cis), gal/min (gpm), litres/min (lpm) or for fuel applications lbs/hr (pph).	**Rated Flow**	QR - The specified control flow corresponding to rated current and given supply and load pressure conditions. Rated flow is normally specified as the no-load flow and is expressed in cis, gpm, lpm or pph.
Flow Gain	The nominal relationship of control flow to input current, expressed as cis/ma, gpm/ma, lpm/ma or pph/ma.	**Load Pressure Drop**	PL **-** The differential pressure between the control ports (that is, across the load actuator), expressed in lbs/in2 (psi), or bars.
Internal Leakage	The total internal valve flow from pressure to return with zero control flow (usually measured with control ports blocked), expressed in cis, gpm, lpm or pph. Leakage flow will vary with input current, generally being a maximum at the valve null (called null leakage).	**Valve Pressure Drop**	The sum of the differential pressures across the control orifices of the servovalve spool, expressed in psi or bars. Valve pressure drop will equal the supply pressure, minus the return pressure, minus the load pressure drop.[PV = (PS–R) – PL]
No Load Flow	The control flow with zero load pressure drop, expressed in cis, gpm, lpm or pph.		

Performance

Frequency Response	The relationship of no-load control flow to input current when the current is made to vary sinusoidally at constant amplitude over a range of frequencies. Frequency response is expressed by the amplitude ratio (in decibels), and phase angle (in degrees), over a specific frequency range.	**Null Bias**	The input current required to bring the valve to null, excluding the effects of valve hysteresis. Expressed as percent of rated current.
Hysteresis	The difference in valve input currents required to produce the same valve output as the valve is slowly cycled between plus and minus rated current. Expressed as percent of rated current.	**Null Shift**	The change in null bias resulting from changes in operating conditions or environment. Expressed as percent of rated current.
Lap	In a sliding spool valve, the relative axial position relationship between the fixed and movable flow-metering edges with the spool at null. Lap is measured as the total separation at zero flow of straight line extensions of the nearly straight portions of the flow curve, drawn separately for each polarity. Expressed as percent of rated current.	**Pressure Gain**	The change of load pressure drop with input current and zero control flow (control ports blocked). Expressed as nominal psi/ma or bars/ma throughout the range of load pressure between ±40% supply pressure.
Linearity	The maximum deviation of control flow from the best straight line of flow gain. Expressed as percent of rated current.	**Symmetry**	The degree of equality between the flow gain of one polarity and that of reversed polarity, measured as the difference in flow gain for each polarity and expressed as percent of the greater.
Null	The condition where the valve supplies zero control flow at zero load pressure drop.	**Threshold**	The increment of input current required to produce a change in valve output. Valve threshold is usually measured as the current increment required to change from an increasing output to a decreasing output. Expressed as percent of rated current.
Performs to Specification	This indicates the unit has been checked against the Moog specification set for the model being tested		

Repair Terms

AFSA	Armature Flapper Sub Assembly.	**LVDT**	Linear Variable Displacement Transducer. This is an electrical linear position sensor used in our electrical feedback valves to measure the spool position within the valve.
Ball Glitch	An expression used to indicate the amount of wear of the feedback wire ball and the interfacing hole/slot in the spool. For more information regarding this please ask for our Technical Look information brochure.	**Motorcap**	This is the external part of the valve covering the torque motor assembly or first stage of the valve. Usually located on top of the valve, usually made of plastic or metal material.
BSA	Bushing and Spool Assembly	**Null Condition**	This is the position of the spool in the valve when 0mA/0V signal is put in to the valve. The null condition is generally expressed as a mA or Voltage level which resembles how far from spool centre electrically the null position is.
Contami-nation	unwanted material in the hydraulic system/component. See common causes of contamination.	**Null Leakage**	This is the measure of leakage from the service ports to the tank when the valve spool is positioned in the null region.
Flapper	A component of the first stage of the valve which acts against the nozzles when a electrical current is applied to the coils. If the flapper is marked as 'ringed' this is a indication the valve has been overdriven or been in service for a long period of time without service. This form part of the AFSA	**Spool**	The part within the valve that physically controls the path of oil through the valve.
Flexure Sleeve	Also referred to as a flexure tube. This is the part of the valve that prevents oil flow to the electrical components of the torque motor. This forms part of the AFSA	**Tare Leakage**	This is the measure of the leakage level in the valve from pressure to tank through the nozzles which control the spool end pressures. For more information please ask for a copy of our Technical Look information brochure
Internal Leakage	Due to the nature in which servovalves are designed there has to be an internal leakage. This can be divided in to two types, tare leakage and null leakage.		