DUTCH ENGINEERING

Workshop/Site Method Statement

Title:	Gearbox Fitting to C-Series
Reason for use:	Information
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- The gearboxes that DES Ltd primarily supplies are the Rotork Gears range, but any Gerboxes with adjustable Mechanical Stops on the gear quadrant can be used. These gearboxes are supplied as standard from DES Ltd with a high temperature trim and invariably a mounting kit in order to protect the gearbox from any conducted or radiated heat that the valve can give out when under temperature as per Mogas Engineering Standard **ESK-3106**. However this does not mean that when lagging the valve after installation, it can be lagged right up to the gearbox. This will create a heat spike which will eventually 'cook' the gearbox and thus hinder its operation and efficiency leading to the eventual breakdown.

- Gearboxes are supplied in order to convert existing site 'multi-turn' electric actuators to a quarter turn application. By doing this, this will save a lot of extra cost and inconvenience that a dedicated actuator will cause in cost of unit and additional wiring up costs. Also manually operated Gearboxes are supplied for high torque Mogas valves where hand levers become impractical. The gearbox is the cheapest component in the valve-actuator package, and for the majority of the time, the root cause of valve failure. The cause of valve failure usually compromises of three faults: incorrect setting of gearbox/actuator stops; or valve stem being driven into valve; or ball being reversed so that unlapped side of ball paired with lapped seat.

- DES Ltd is providing this report is a guide to handling the valve and gearbox/actuator packages when installing and commissioning them on site.

- Please note: **Clockwise to close; Counter Clockwise to open.** Mogas Ball Valves have a **96^{o}** travel, allowing an extra 3^{o} of travel either side of open or closed. This is to allow thermal expansion of the stem under temperature.

Gearbox/Actuator Installation:

- The majority of the time DES Ltd supply the Mogas Ball Valves complete with gearboxes fitted. Please note that the stops would have been set at our works allowing for a ½ turn back-off for the actuation stops (if motorized), for manually operated Worm Gears, this is not applicable. DES Ltd recommends that if the valves are supplied with the gearboxes prior to installation (welding), they will not have to be altered. DES Ltd also recommend that the valves should be installed with Gearboxes on as removal may affect warranty.

- The only point that Mogas and DES Ltd stress when welding is to leave the valve open. This will allow the free movement of air/heat in the line otherwise the ball in the closed position will act as a barrier and allow the heat to build up around the ball and hence conduct through the stem. Also this will avoid weld splatter settling on ball causing damage during cycling.

- Where ever possible, try and fit gearboxes/actuators to the valves in workshop as opposed to in line. It is easier to check to see if the valve is fully open (smooth bore) or fully closed.

Workshop Installation:

1. Set valve to fully open position. This is your reference point to establish the fully closed stop.
2. Attach Mounting Bracket (adaptor plate) and Stem Adaptor (stem coupling) made to Mogas Engineering Standard **ESD-4116**. Please do not tighten bolts as you may need the initial play later to help line up the bolt holes for the actuator/gearbox.
3. Before attaching gearbox, please ensure that the gearbox is fully open (rotate counter clockwise fully).
4. Attach the gearbox/actuator to the mounting bracket ensuring that a slide fit has occurred between the male insert of adaptor (coupling) and the female connection of the gearbox/actuator drive bush. If you cannot achieve a slide fit, **DO NOT FORCE THE GEARBOX/ACTUATOR** on to the coupling. This will potentially cause the stem to be pushed in and thus rolling the ball off the seat (guaranteed leakage). Please use emery cloth or any other means necessary to ensure a slide fit.
5. Once the gearbox/actuator has been successfully placed on to the valve, this is where all the nuts & bolts need to be tightened. Please note that all fittings should come with Norlock or shake-proof washers, if not please inform DES Ltd or supply own. This helps to secure gearbox/actuator to the valve, especially under any continuous vibration which may cause the gearbox to shake loose.
6. When adjusting the closed/open stops on the gearbox, there are two studs with locking nuts on the gearbox opposite the worm drive. The left hand stop will allow you to adjust the open position of the valve. The right hand stop adjusts the closed position
7. Setting the open stop on the gearbox, the valve should be fully open, however make sure that the stop is unwound slightly to allow for an extra **½ turn** allowance for the actuator stops (if applicable). If the ball of the valve has encroached into the flow path (look up the bore of valve) unwind the gearbox until full bore and then set stops as above (allowing for actuator).
8. To set the closed stop, wind the gearbox clockwise from the open stop until the point when the ball begins to move. From here using a protractor, square or any other instrument to accurately give you 90^{o}. From here you will be able to find your closed stop exactly. Mark this point on the gearbox in relation to the pointer on the gearbox indicator plate so that when the gearbox rotates clockwise, the gearbox indicator pointer lines up with the mark made. This is your close stop.
9. **Before setting Actuator Limit stops (if necessary), please back off ½ turn away from where Mechanical stops have been set at each end of the cycle.**

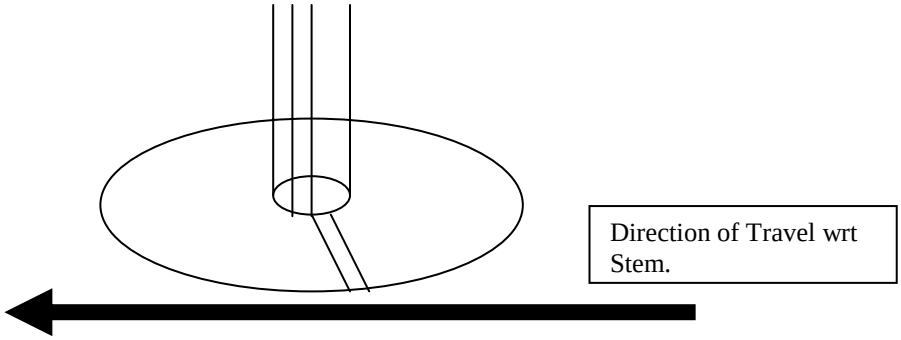
Please note: There is an allowance for a 5% Over/Under Travel in the Mogas design. However the above ensures that you are well within tolerance.

In Line Installation:

We all wish we had the luxury of fitting anything on the work bench rather than in line, alas this is not always possible.

1. It is not important whether the valve stops are set from the open position or not. Yet to maintain the discipline you may find it easier to do this. Whether setting open or closed first, **MAKE SURE THAT THE GEARBOX OPEN/CLOSE POSITION CORRESPONDS TO THE VALVE OPEN/CLOSE POSITION.** You can ascertain if the valve is fully open or closed by two methods:
    - Scribe Lines on Valve Stem and Gland flange. On the C-Series (Gen-X) range, the scribe line in the closed position will be pointing downstream in line with the flow and will be in line (roughly) with the scribe line on the flange. In the open position, the scribe line will be perpendicular to the flow. (Remember Clockwise to Close, etc…)
    - T-stamp on top of Valve Stem. If flat part of 'T' (rather than trunk) is pointing downstream (direction of flow) then valve is closed and ball is in correct orientation to the seat (mate-lapped side to lapped).
2. Attach mounting kit and stem adaptor (as above workshop installation). If kit already mounted, it would be advisable to slacken the bolts to allow some play so that you can line up gearbox bolt holes easily to the bracket.
3. Attach the gearbox/actuator to the mounting bracket ensuring that a slide fit has occurred between the male insert of adaptor (coupling) and the female connection of the gearbox/actuator drive bush. If you cannot achieve a slide fit, **DO NOT FORCE THE GEARBOX** on to the coupling. This will potentially cause the stem to be pushed in and thus rolling the ball off the seat (guaranteed leakage). Please use emery cloth or any other means necessary to ensure a slide fit.
4. Once the gearbox has been successfully placed on to the valve, this is where all the nuts & bolts need to be tightened. Please note that all fittings should come with Norlock or shake-proof washers, if not please inform DES Ltd or supply own. This helps to secure gearbox/actuator to the valve, especially under any continuous vibration which may cause the gearbox to shake loose.
5. When adjusting the closed open stops on the gearbox, there are two studs with locking nuts on the gearbox opposite the worm drive. The left hand stop will allow you to adjust the open position of the valve. The right hand stop adjusts the closed position
6. To set the open stop, please cycle the valve so that the scribe line on the stem just passes the scribe line on the flange (by width of scribe line), then set gearbox/ actuator Mechanical Stop.
7. When setting closed stop, if over-travel by width of scribe line, that is where closed stop is. (See below diagram) then set gearbox/actuator Mechanical Stop.
8. **Before setting Actuator Limit stops (if necessary), please back off ½ turn away from where Mechanical stops have been set at each end of the cycle.**

<u>Please note: There is an allowance for a 5% Over/Under Travel in the Mogas design. However the above ensures that you are well within tolerance.</u>


Direction of Travel wrt Stem.