- The gearboxes that DES Ltd primarily supplies are the Rotork Gears range. 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. 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. However 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 **1 - 1 ¼ turns** back-off for the actuation limits. DES Ltd recommends that if the valves are supplied with the gearboxes prior to installation (welding), they will not have to be altered, as these have been workshop set.

- Furthermore when welding the valves in line, even if the valves have to go through a Post Weld Heat Treatment process, there is no need to remove the gearboxes. These are mechanical devices purely (no chance of electrics being 'cooked') and with the high temp trim and mounting kit will be far away from the valve not to be cooked. 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. Further to this, **do not** insulate or wrap the thermocouples around the entire valve.

Workshop/In line Installation:

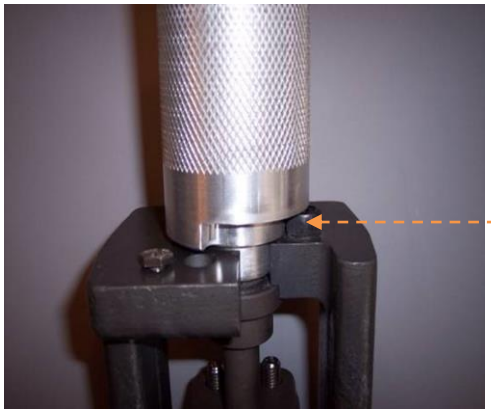
1. As stated above, the gearbox stops have already been set to suit the Mogas ball valve. This section is concerning the set-up of the Auma actuator to the gearbox stops.
2. It does not matter if you start from the open or closed position, but since the valve should have been welded in with the valve in the open position, let's start from this position. The original drive nut needs to be removed from Auma as this is threaded, and the new drive nut will be bore and keyed as per the gearbox input shaft.
3. There is a thrust base on the bottom of the Auma actuators, this needs to be removed as well as this is redundant to the current requirement. What should be left is a base pad which should have a PCD (BCD) of 102mm (F10) or 140mm (F14) depending on the actuator type. The newly supplied drive nuts need to be fitted before the actuator can be mounted to the gearbox.
4. Once the actuators have been mounted and the fasteners fitted, it is now time to turn our attention to the limits. The selector switch on the local control needs to be set to '0' before the limits & torques can be adjusted. The casing and then the indicator plate need to be removed from the top of the Auma control unit. Since the valve is in the fully open position, the Auma actuator needs to be rotated counterclockwise so that the actuator engages fully with the gearbox and makes the gearbox stop.
5. DES Ltd recommend rotating the Auma Handwheel clockwise by 1 ¼ turns (no more) so that the Auma is backed off the gearbox. The open electrical limit spindle (spindle D in the Auma Handbook) is pressed down using a screw driver and rotated in the direction of the arrow (which should be clockwise) and thus observe the pointer E. While a ratchet is felt and heard, the pointer E moves 90 degrees every time. When the pointer is 90 degrees from mark F, continue more slowly. When the pointer E has reached the mark F, stop turning and release the setting spindle. If you have inadvertently overridden the tripping point, continue turning the setting spindle in the same direction and repeat above. Once the pointer has been set, rotate the Auma Handwheel and thus the valve clockwise by 6 – 8 turns so that the actuator is backed of its electrical limit. Rotate the Handwheel counterclockwise until the pointer moves to mark F, hopefully this pointer moves before the torque switches are engaged, open limit is set. If the torque switches engage before the pointer moves to mark F, then we need to re-set the Electrical limits. This is done by rotating the Handwheel counterclockwise until it engages with the gearbox stops and backing off the gearbox stops clockwise by an extra ¼ turn on previous. Then the above has to be repeated. In DES Ltd experience, only 1 ¼ turns are required maximum to set the electrical limits, no more.
6. With respect to the closed stops, the actuator needs to be rotated clockwise until it hits the closed Gearbox stop. DES Ltd recommend rotating the Auma Handwheel counterclockwise by 1 ¼ turns (no more) so that the Auma is backed off the gearbox. The closed electrical limit spindle (spindle A in the Auma Handbook) is pressed down using a screw driver and rotated in the direction of the arrow (which should be counterclockwise) and thus observe the pointer B. While a ratchet is felt and heard, the pointer B moves 90 degrees every time. When the pointer is 90 degrees from mark C, continue more slowly. When the pointer B has reached the mark C, stop turning and release the setting spindle. If you have inadvertently overridden the tripping point, continue turning the setting spindle in the same direction and repeat above. Once the pointer has been set, rotate the Auma Handwheel and thus the valve counterclockwise by 6 – 8 turns so that the actuator is backed of its electrical limit. Rotate the Handwheel clockwise until the pointer moves to mark C, hopefully this

pointer moves before the torque switches are engaged, closed limit is set. If the torque switches engage before the pointer moves to mark C, then we need to re-set the Electrical limits. This is done by rotating the Handwheel clockwise until it engages with the gearbox stops and backing off the gearbox stops clockwise by an extra ¼ turn on previous. Then the above has to be repeated. In DES Ltd experience, only 1 ¼ turns are required to set the electrical limits, no more.

7. Then the torque setting needs to be set next. Even though the actuator is set to go out on limits, the torques are set so that the actuator does not exceed the mast limitation. DES Ltd supply 40:1 gearboxes sized to suit the actuator stall torque. These gearboxes have a mechanical advantage which can be used to calculate the limit of the Actuator torque output to below the valve mast limitation. The recommended maximum actuator torques are as follows:

RSVP Model	Max Recommended RSVP Torques	Auma Multi-Turn Model Max Torques	Gearbox Model & Mechanical Advantage	SA(M) Torque Setting
RSVP-UC 1500#	90Nm max	SA07 = 30Nm SA7.5 = 60Nm	IW3 40:1 = 15 MA IW3 40:1 = 15 MA	SA07 = 6Nm max SA07.5 = 6Nm max
RSVP-UF 1500#	250Nm Max	SA07 = 30Nm SA7.5 = 60Nm SA10 = 120Nm	IW3 40:1 = 15 MA IW3 40:1 = 15 MA IW4 40:1 = 15 MA	SA07 = 15Nm max SA07.5 = 15Nm max SA10 = 15Nm max
RSVP-UL 1500#	450Nm max	SA07 = 30Nm SA7.5 = 60Nm SA10 = 120Nm	IW3 40:1 = 15 MA IW3 40:1 = 15 MA IW4 40:1 = 15 MA	SA07 = 30Nm max SA07.5 = 30Nm max SA10 = 30Nm max
RSVP-UM 1500#	700Nm max	SA7.5 = 60Nm SA10 = 120Nm	IW3 40:1 = 15 MA IW4 40:1 = 15 MA	SA07.5 = 45Nm max SA10 = 45Nm max
RSVP-UC 3100#	175Nm max	SA07 = 30Nm SA7.5 = 60Nm SA10 = 120Nm	IW3 40:1 = 15 MA IW3 40:1 = 15 MA IW4 40:1 = 15 MA	SA07 = 12Nm max SA07.5 = 12Nm max SA10 = 12Nm max
RSVP-UF 3100#	330Nm max	SA07 = 30Nm SA7.5 = 60Nm SA10 = 120Nm	IW3 40:1 = 15 MA IW3 40:1 = 15 MA IW4 40:1 = 15 MA	SA07 = 22Nm max SA07.5 = 22Nm max SA10 = 22Nm max
RSVP-UL 3100#	560Nm max	SA7.5 = 60Nm SA10 = 120Nm SA14.1 = 250Nm	IW3 40:1 = 15 MA IW4 40:1 = 15 MA IW5 40:1 = 17 MA	SA07.5 = 38Nm max SA10 = 38Nm max SA14 = 33Nm max
RSVP-UM 3100#	TBC			

8. When electrically cycling the valve open and closed, it would do well to check the actual valve stops (see below). These are located at the base of the valve to gearbox coupling and the top of the valve itself. There is a Cap Head screw on top the valve that slots into a pre-machined profile in the base of the coupling. This the pre-machined profile and has been machined so that there cannot be any over-travel. However there can still be some under-travel, so when cycling the valve open and closed, ensure that the gap between the machined profile and the cap head screw is no larger than **0.5mm** or else the valve could be slightly open when it hits the closed stop. If this gap is bigger than 1mm, return to step 6 or seven and instead of backing of 1 ¼ turns, back off only 1 turn instead. I do not believe this will be required and this can easily be rectified when Bill Burrows visits site to commission the valves.



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.