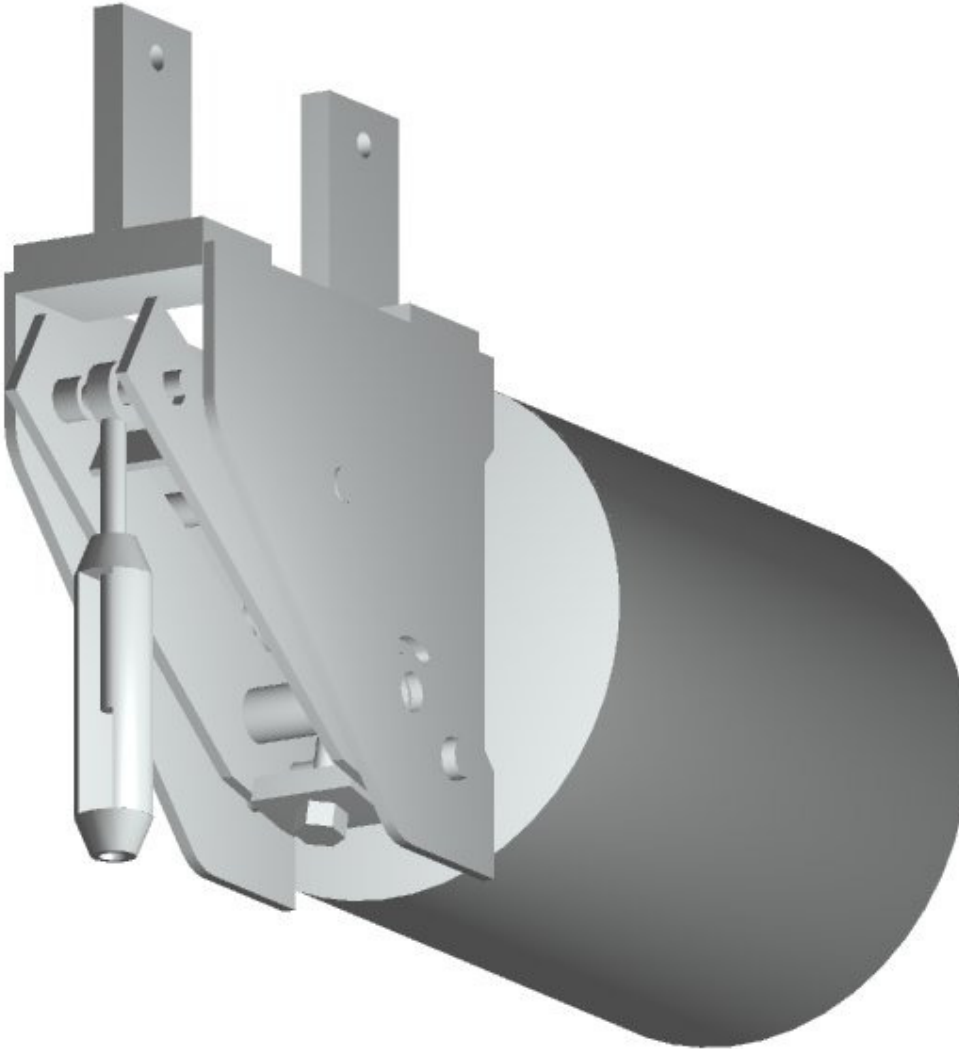


CONSTANT EFFORT SPRING SUPPORTS INSTALLATION AND DECOMMISSIONING INSTRUCTIONS



2	20/11/2008	Multi Lock Operational Procedure Added	BP	RA
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1.0 DESCRIPTION – GENERAL

The constant effort spring support comprises a spring loaded lever arm, connected to pipe-work by either a drop rod or load flange arrangement.

Front and rear views of a typical constant effort support indicating the major components are shown following: *Please Note: Multi-Lock assembly is not shown, see Section 8.2 for details.*

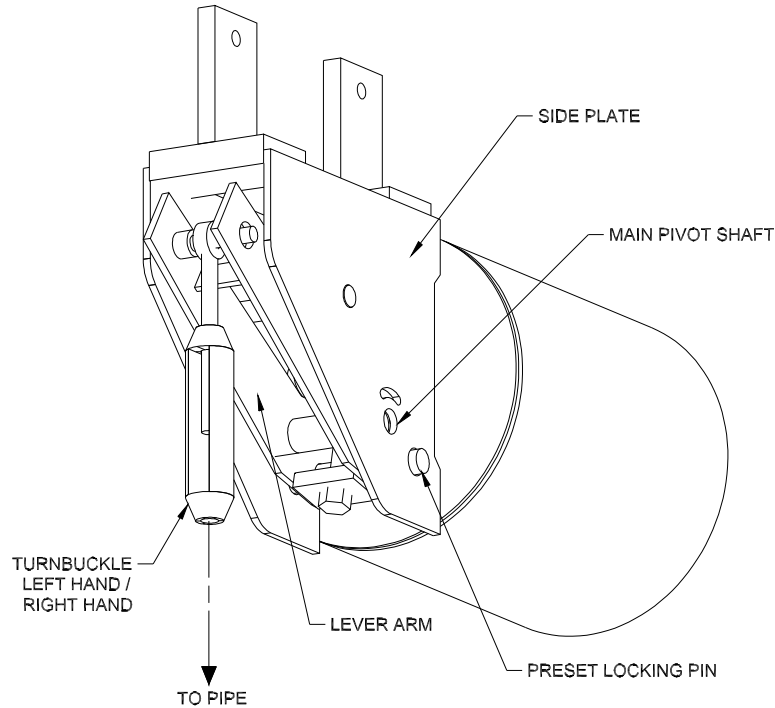


Figure 1.1 : Front View – Typical – Constant Effort Support

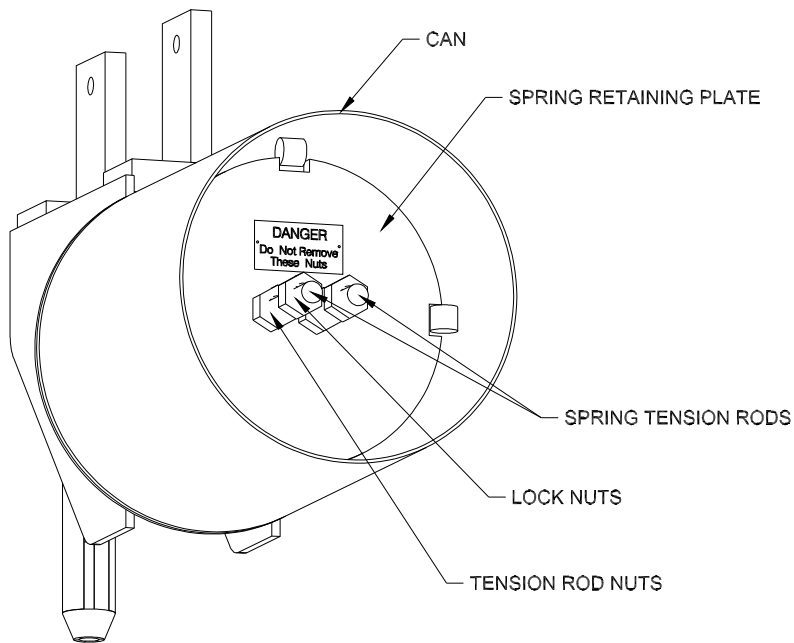


Figure 1.2 : Rear View – Typical – Constant Effort Support

A cutaway view of the typical support is shown below. Major components of the support are labeled:

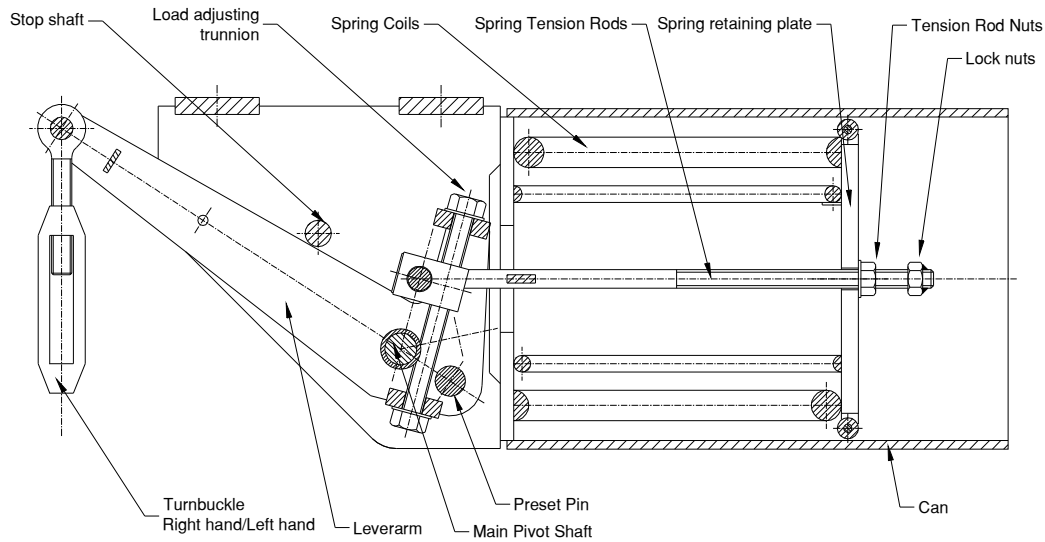


Figure 1.3 :Cutaway View – Typical Constant Effort Support

2.0 CONSTANT EFFORT SUPPORT OPERATING PRINCIPLE

The pipe is supported by a drop rod connected via a turnbuckle to the end of the lever arm.

The spring coil applies a force to the trunnion arm of the lever which tends to pull the lever-arm UP against the load of the pipe.

The lever arm is able to swing through an arc of 45°; i.e. from 33° above horizontal to 12° below horizontal.

The geometry of the lever arm provides a balance between the pipe load and spring force. The pipe may therefore move due to thermal expansion or structural subsidence while being supported with a nominally constant force through this range of travel.

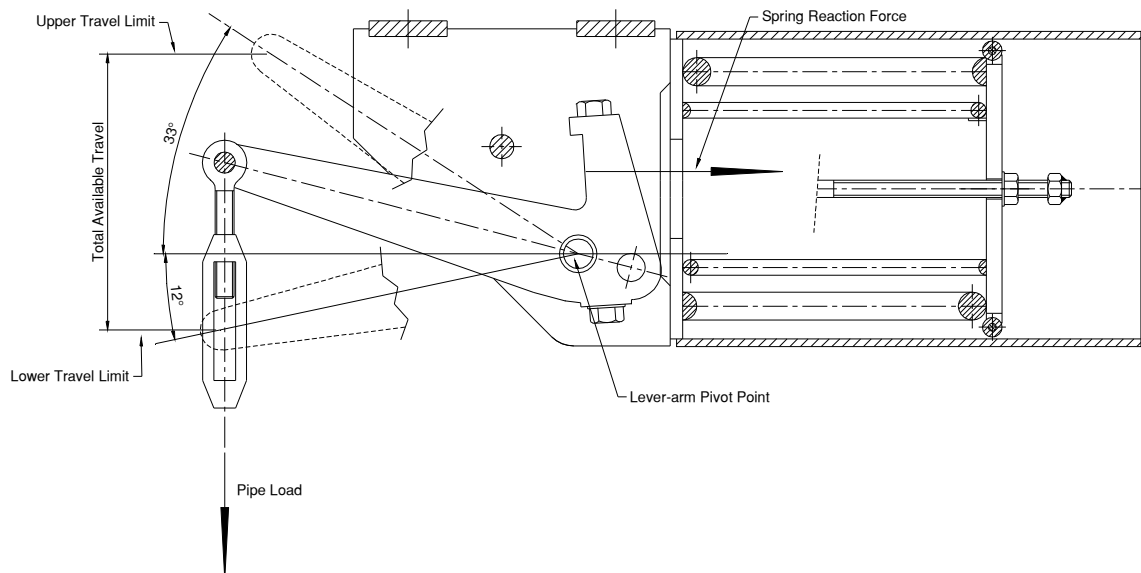


Figure 1.4 : Principle of Operation

3.0 SAFETY

The Constant effort support relies on the compressed spring to provide the force required to support the pipe.

There is a considerable amount of stored energy within the support (up to 8500kg) and the support may therefore be viewed as a very large mouse trap !. Severe injuries may result from improper handling of the constant effort support.

Installing, adjusting and removing the constant support must be undertaken with due care and with an understanding of the operation of the support.

3.1 LOCKING OR “PRE-SETTING” THE CONSTANT EFFORT SUPPORT

All constant effort supports are supplied with the lever arm pre-set, or locked, in a pre-determined position. The lever arm is locked by a pin which passes through the support's side plates and through the lever arm.

The position at which the lever arm is locked is determined at the design stage. Each support is fabricated with the specific preset position bored in the unit's side plates.

By providing a pre-set, the constant effort support is supplied in a position suitable for startup.

Once the lever arm is locked by the preset pin, the support may be safely disconnected from the line and removed.

THE SUPPORT MUST NOT BE DISCONNECTED FROM THE PIPE OR STRUCTURE WITHOUT FIRST LOCKING THE LEVER ARM USING THE LOCKING PIN.

3.2 SPRING TENSION RODS – LOCKING NUTS

The coil spring is compressed and held compressed by screwing nuts down the spring tension rods against the spring retaining plate. The spring coils is compressed in the factory and lock nuts are welded to the tension rods to prevent further adjustment. A warning plate advising of the danger of undoing the tension rod nuts is fixed to the spring retaining plate.

WARNING – UNDER NO CIRCUMSTANCES SHOULD THE TENSION ROD NUTS BE ADJUSTED OR REMOVED.

4.0 INSTALLATION OF THE CONSTANT EFFORT SUPPORT

These instructions assume the installation is taking place on a “cold” system, i.e. the system is not operating and no thermal expansion has or is being witnessed.

4.1 FIXING TO STRUCTURE

This instruction does not cover methods for fixing to the structure. It is assumed all necessary weldments have been appropriately selected and installed. It is further assumed that the locked constant effort support has been correctly identified and is hung or fixed to the structure in the correct location.

4.2 COMPLETION OF INSTALLATION AND HYDROSTATIC TESTING PRIOR TO REMOVAL OF PRESET

Prior to removal of the locking pin on the constant effort support, the pipework system should be completely installed i.e. terminated at nozzles. Hydrostatic tests should be performed on the pipework system as required.

Following hydrostatic testing, prior to any attempt to adjust load on the constant effort supports, any temporary supports installed for test purposes must be removed.

4.3 FIRST OFF INSPECTION OF CONSTANT EFFORT SUPPORTS – REVIEW OF PRESET PIN POSITION

Each constant effort support should be inspected prior to commencing the process of preset pin removal. This inspection should note the position of the preset pin in relation to the support's side plates. The position of the pin provides an indication of whether the support is carrying either more or less the design load and from these observations a decision may be made with regard to the adjustment required.

4.4 IDENTIFICATION OF UNITS CARRYING LESS THAN DESIGN LOAD

A constant effort support which is carrying less than the design load will have the preset pin driven DOWN against the lower edge of the preset hole on the side plates. The figure 1.5 below illustrates this condition:

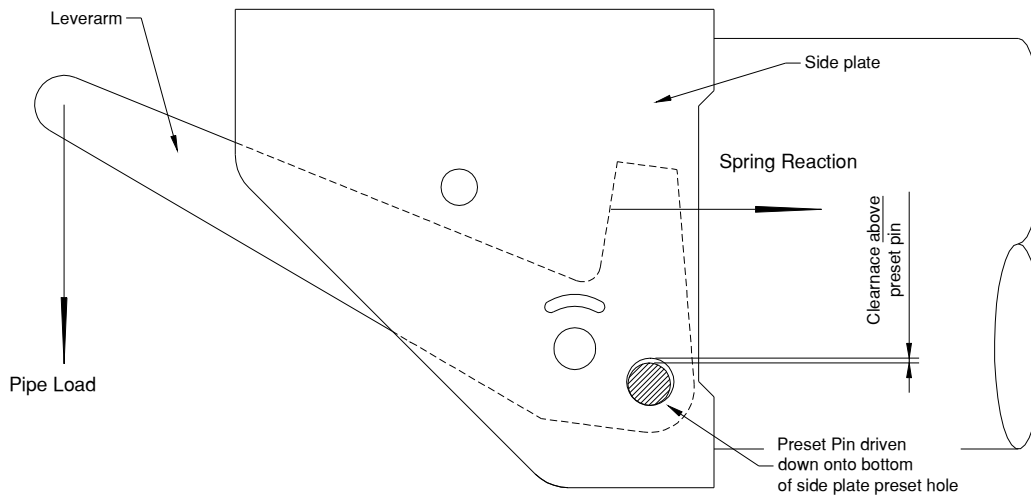


Figure 1.5 : Constant Effort Support Carrying Less than Design Load

4.5 ADJUSTMENT OF UNITS CARRYING LESS THAN DESIGN LOAD

On units which exhibit the above, load is transferred to the support by rotation of turnbuckle as indicated on the illustration below:

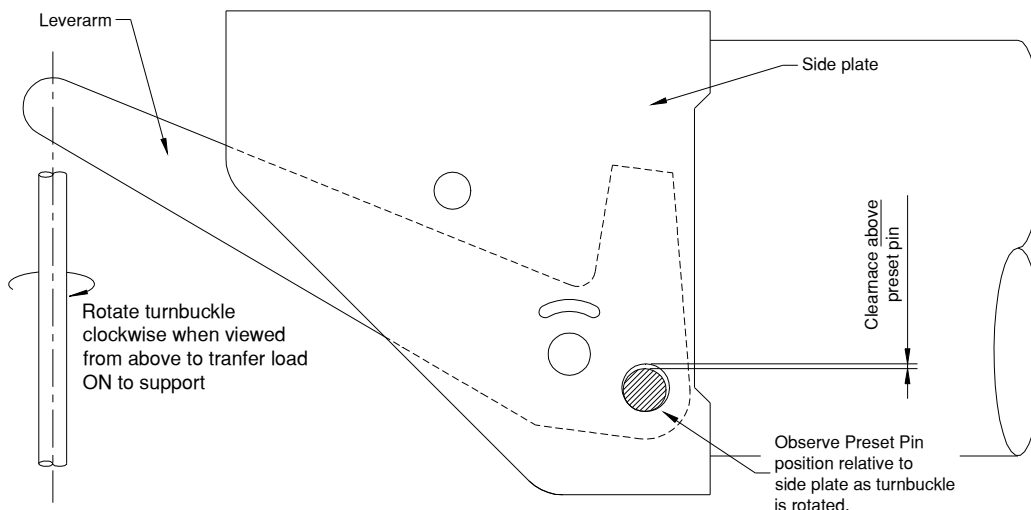


Figure 1.6 : Sense of Turnbuckle Rotation to Transfer Load ON to Support

As the turnbuckle is rotated the clearance between preset pin and side plate must be observed.

By lightly “ringing” the preset pin as load is transferred onto the support, the point at which the preset pin becomes free and the unit is supporting the design load may be determined. Adjustment should cease once the pin is freed and the pin should be left in position while adjustment of other supports is undertaken.

All units observed to be carrying insufficient load should be treated in this manner.

4.6 IDENTIFICATION OF UNITS CARRYING GREATER THAN DESIGN LOAD

During installation, there is potential for constant effort supports to be exposed to a pipe load greater than the design operational load. In this situation, the pipe load will overwhelm the spring coil reaction and the preset pin will be driven UP against the upper edge of the preset hole on the side plates. The figure below illustrates this condition:

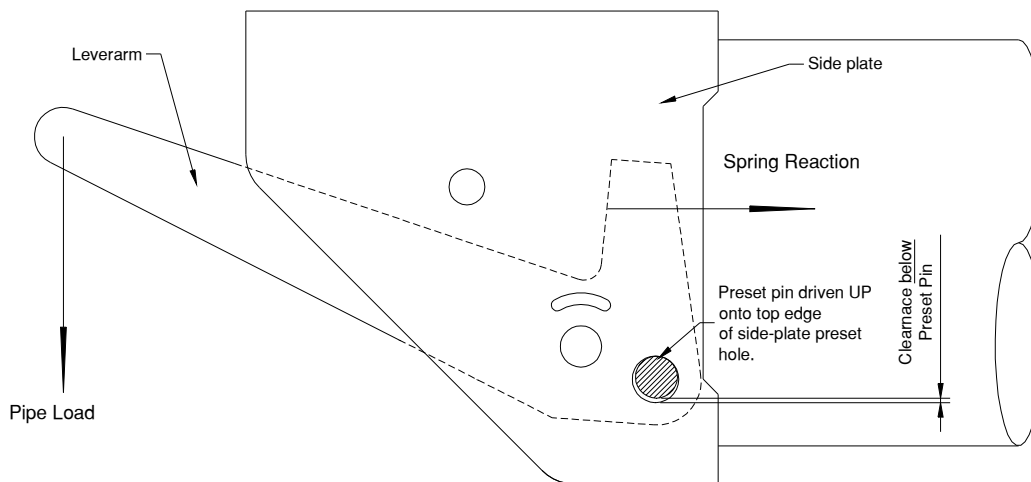


Figure 1.7 : Constant Effort Support Carrying Greater than Design Load

4.7 ADJUSTMENT OF UNITS CARRYING GREATER THAN DESIGN LOAD

On units which exhibit the above condition, i.e. a load greater than the design load is carried by the support, load is transferred OFF the support by rotation of turnbuckle as indicated on the illustration overleaf:

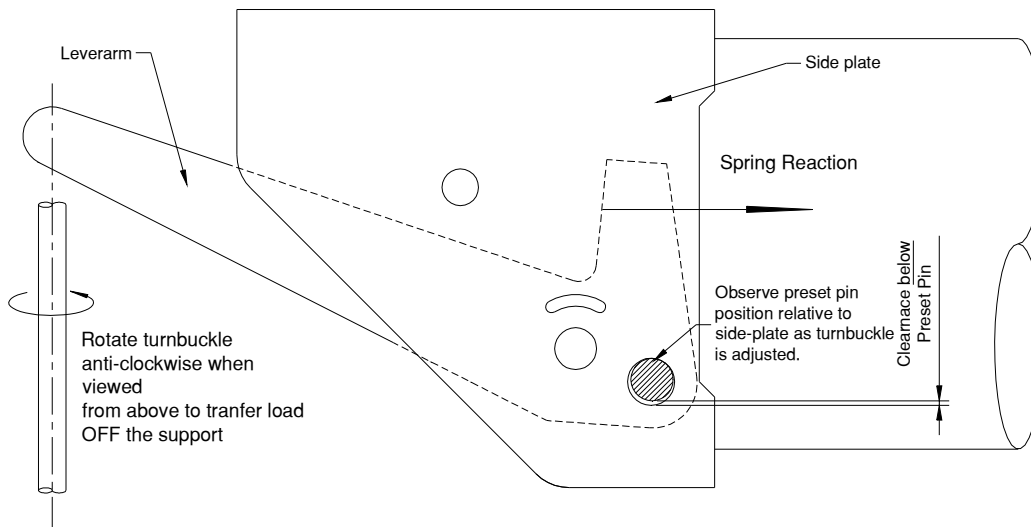


Figure 1.8 : Sense of Turnbuckle Rotation to Transfer Load OFF to Support

5.0 SEQUENCE OF ADJUSTMENT AND PRESET PIN REMOVAL

Situations will often be encountered where more than one spring support is fitted to a single line. In these situations, the adjustment of the supports, as per the preceding, to allow removal of the preset pin is a balancing exercise – as load is transferred ON to one unit, it will potentially be taken OFF an adjacent unit and vice-versa.

The following sections recommend the sequence for adjustment of supports to enable removal of preset locking pins prior to commissioning. It has been assumed that prior to any attempt to remove preset locking pins, all supports have been inspected as per section 3. Please note that once the preset locking pin is freed, it is recommended that it is left in position until ALL adjacent units are “free” and that the pins be removed on a final pass along the line.

5.1 HORIZONTAL PIPE RUNS

For horizontal pipe runs, it is recommended that adjustment to permit preset pin removal be conducted as per the following sequence:

- 1 Identify units exposed to loads below the design and adjust as per section 4.5. Leave preset pin in position but freed for later removal.
- 2 Identify units exposed to loads greater than the design and adjust as per section 4.7. Leave preset pin in position but freed for later removal.
- 3 Commence final pass adjustment at supports nearest rigid supports or nozzle terminations. Leave preset pins in position.
- 4 Progressively adjust supports in sequence moving from “fixed” locations progressively toward the center of the span of interest.
- 5 Having freed all preset pins, pass along the span, remove pins and insert in stowage region.

An example of this recommended sequence of adjustment is shown on the illustration overleaf:

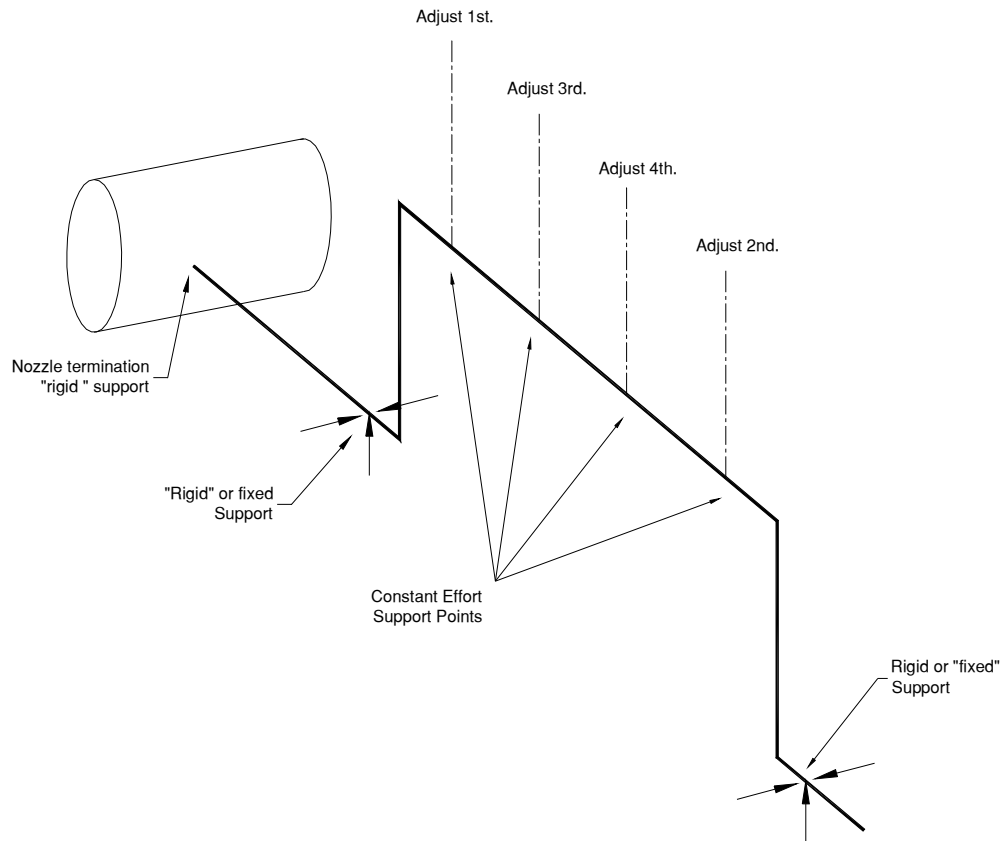


Figure 1.9 : Recommended Sequence of Adjustment – Horizontal Pipe Runs

5.2 VERTICAL PIPE RUNS – RISERS

For vertical pipe runs, it is recommended that adjustment to permit preset pin removal be conducted as per the following sequence:

- 1 Commence with the unit immediately below either a rigid support or nozzle termination.
- 2 Identify whether this unit is exposed to a load greater than or less than the design load and adjust as appropriate (see sections 4.5 and 4.7). Leave the preset pin in position but freed for later removal.
- 3 Move to the next constant effort support BELOW and repeat operations in step 2.
- 4 Progressively adjust supports in sequence moving DOWN the riser from "fixed" locations progressively toward the lower end of the span of interest.
- 5 Having freed all preset pins, pass along the span, remove pins and insert in stowage region.

An example of this recommended sequence of adjustment is shown on the illustration overleaf:

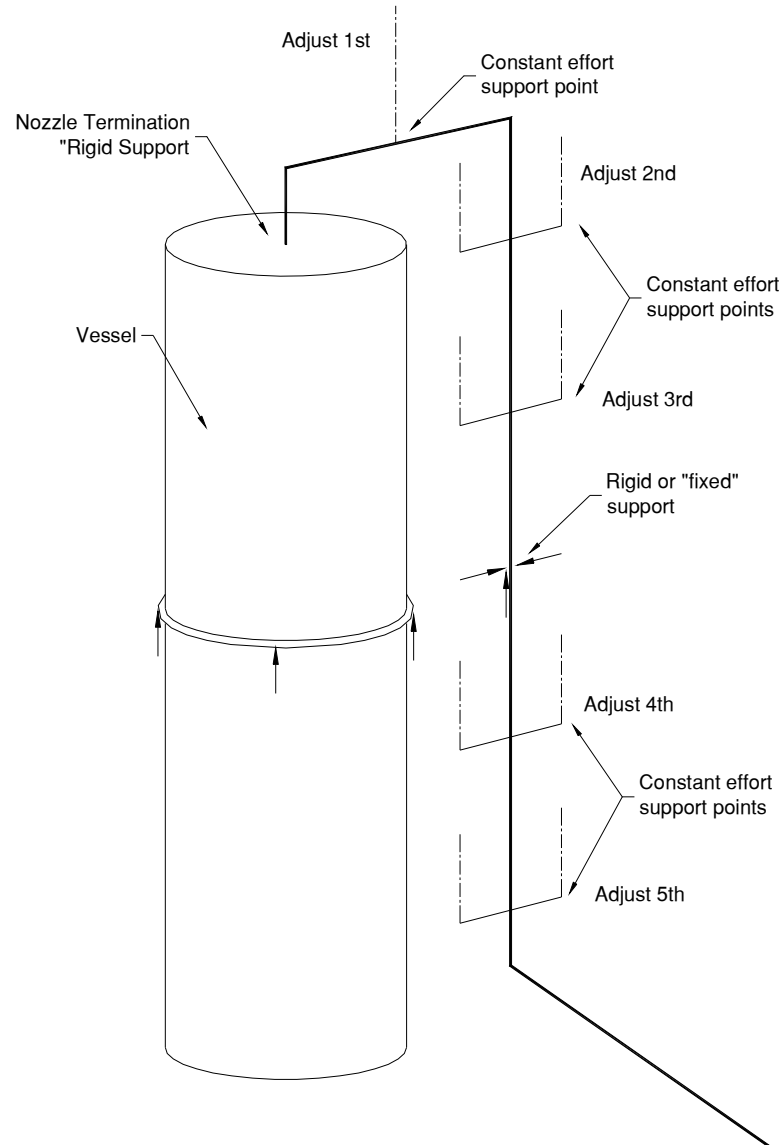


Figure 2.0 : Recommended Sequence of Adjustment – Vertical Pipe Runs

6.0 INSPECTION DURING OPERATION

6.1 RECORD STARTUP POSITION

Once the preset locking pins have been removed, the constant effort support's lever arm should not swing from the cold (or startup position). The orientation of the lever-arm should be noted and marked on the either the side plate or travel scale fixed to the side of the constant.

6.2 MONITOR LEVER-ARM MOVEMENT DURING STARTUP

As the system is run up to operating condition, the movement of the lever arm should be monitored. Particular attention should be paid to the upper and lower limits of travel for the lever arm. **IT IS IMPERATIVE THAT THE CONSTANT EFFORT SUPPORT DOES NOT CONTACT THE TRAVEL LIMIT STOPS DURING OPERATION.** This condition will render the support solid and over-stressing of the system becomes a significant danger.

The orientation of the lever-arm during operation should be noted and marked on the either the side plate or travel scale fixed to the side of the constant. This marked point may be readily used to monitor operating conditions.

7.0 CONSTANT EFFORT SUPPORT MAINTENANCE

Maintenance requirements for the constant effort supports are minimal. The following observations are recommended:

Monitor condition of surface treatment and touch up as necessary
Maintain a covering of appropriate lubricant on drop rod threads to facilitate removal of the constant.
Monitor the operational range of movement of the lever-arm and note any deviations from the range originally identified as described in section 5.

8.0 REMOVAL OF CONSTANT EFFORT SUPPORTS

Removal of constant effort supports is the reverse of the installation procedures.

It is assumed that the system has undergone cool-down and the lever-arm has returned to a position either at or very close to the original cold installed position. It should be possible to re-insert the preset locking pin through the side plates and lever-arm to lock the unit and make it safe for removal.

NOTE : THE LEVER-ARM MUST BE LOCKED BY INSERTION OF THE PRESET LOCKING PIN PRIOR TO ANY ATTEMPT TO REMOVE THE UNIT

If the constant effort support has a multi-locking device installed and the preset holes can not be aligned, please refer to Section 8.2 for locking the constant prior to removal from pipe line.

A minor adjustment via rotation of the turnbuckle may be required to align the preset pin holes and allow insertion of the preset pin.

The diagrams following illustrate the adjustment required to align the preset holes on the lever-arm and side plate to allow insertion of the preset pin:

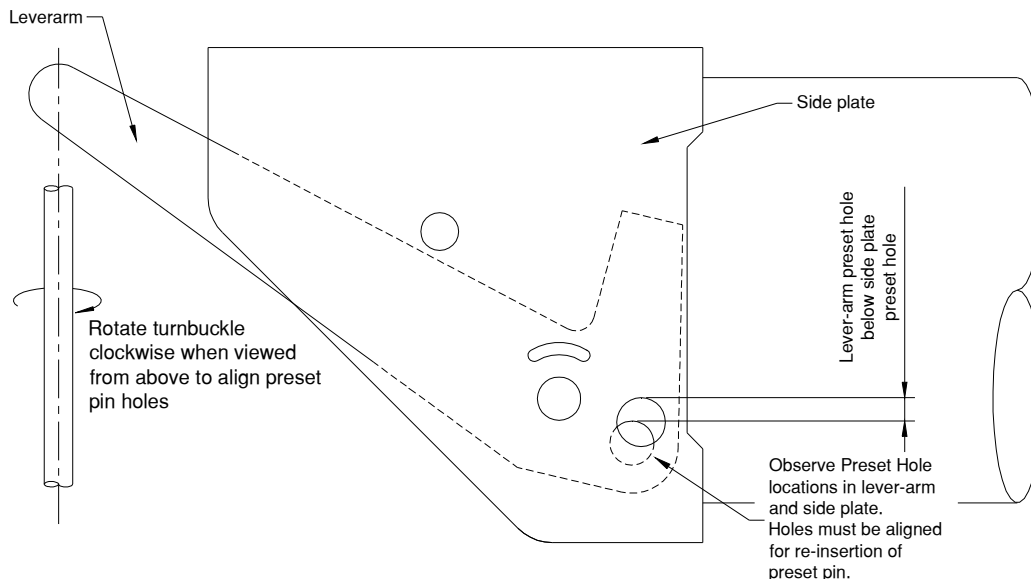


Figure 2.1 : Adjustment for Insertion of Preset Pin
Lever-Arm preset hole “below” side plate preset hole

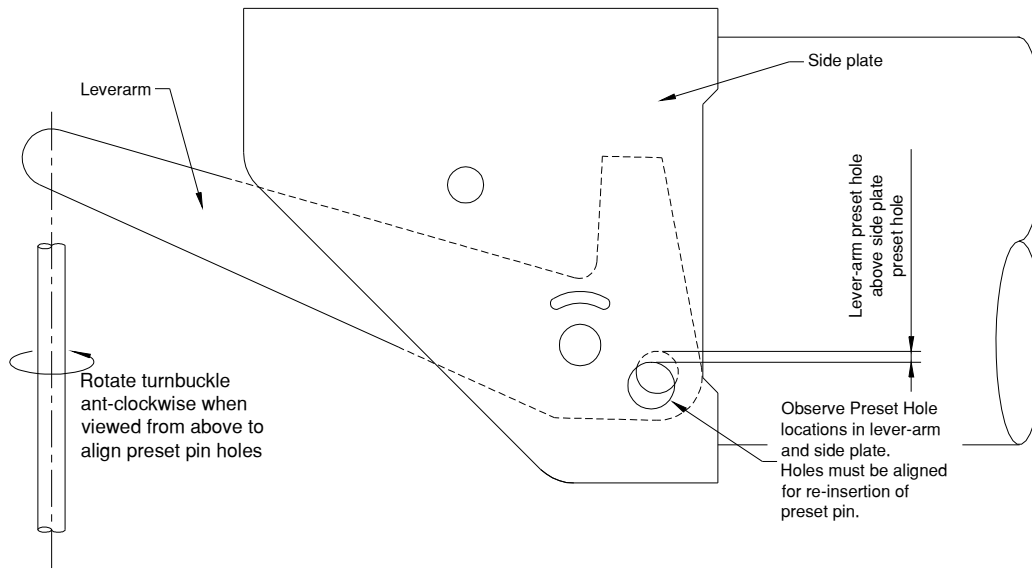


Figure 2.2 : Adjustment for Insertion of Preset Pin
Lever-Arm preset hole “above” side plate preset hole

When adjusting the turnbuckle, particular attention must be paid to the amount of thread engaged in the turnbuckle. Adjustment must cease if thread is not visible within the turnbuckle gate. Note that disconnecting the drop rod from the pipe (by adjustment of the turnbuckle) without first locking the support.

8.1 SITUATIONS WHERE PRESET HOLES CANNOT BE RE-ALIGNED

In certain applications, the constant effort support is utilized to accommodate subsidence of a structure in relation to the pipeline. In these situations it may not be possible to re-align the preset holes if significant subsidence has occurred.

The lever arm must still be locked by to enable safe removal of the support.

(Where a “multi-locking device” is not fitted to the constant effort support) In these situations it is suggested that the lever arm be locked by inserting an appropriate packer between the lever-arm and the can end plate and permitting the lever-arm to bear against this packer. Removal of pipe load from the constant effort support will jam the packer in place and the support may be removed with care:

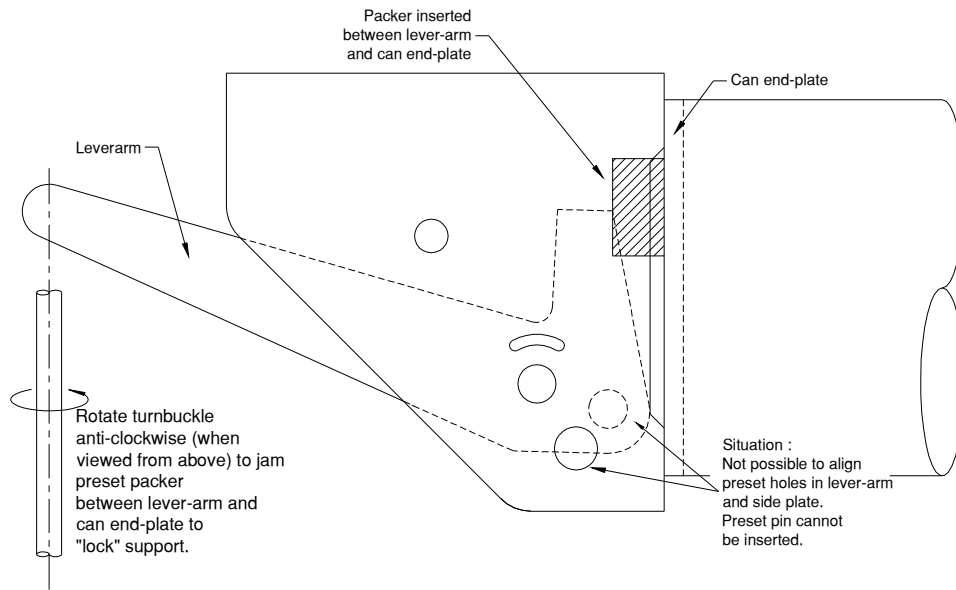


Figure 2.3 : Adjustment by inserting an appropriate packer between the lever-arm and the can end-plate.

8.2 OPTIONAL MULTI-LOCKING DEVICE – “MULTI-LOCK”

An optional multi-locking device is available for all constant effort supports. This device locks the constant effort support without the need to re-insert the preset pin. The constant effort support can be locked with the lever arm being at any angle. There are two types of Multi-locking devices, one for the BC50, BC51, BC53 and the BC54, the other to suit the BC52 and the BC55.

The multi-locking device requires modified tension rods (BC52's). At time of quotation, the client must inform the Binder Group that a multi-locking device is required. This device cannot be added to an existing constant effort support that has the standard tension rods.

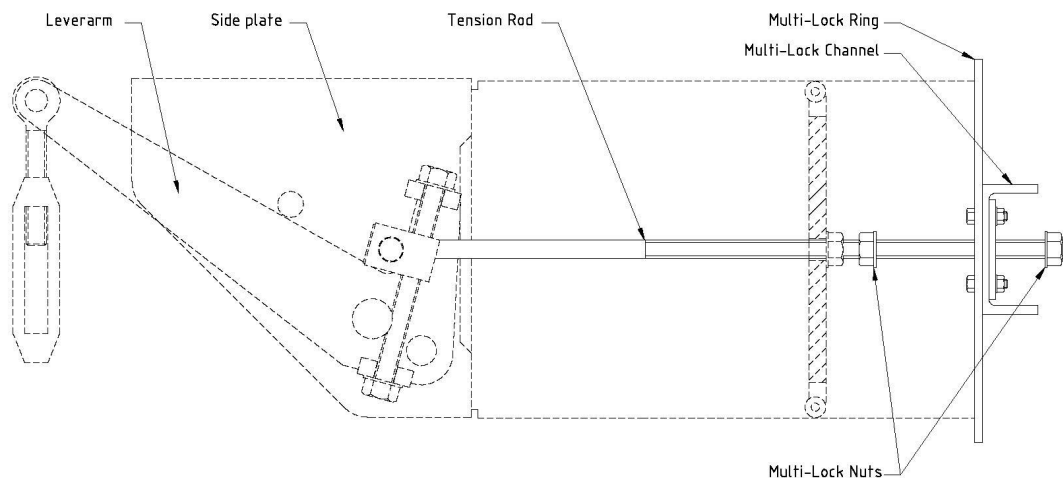


Figure 2.4 : Hanging Constant. Multi-lock assembly shown for BC50, BC51, BC53 & BC54
Multilock nuts are wound out to ends – Operational condition.

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The constant effort support will still be supplied with a pre-set pin set in the pre-set position, this locks the lever arm in position and the multi-locking device will be set to “operational condition”. See Figure 2.4 & 2.5.

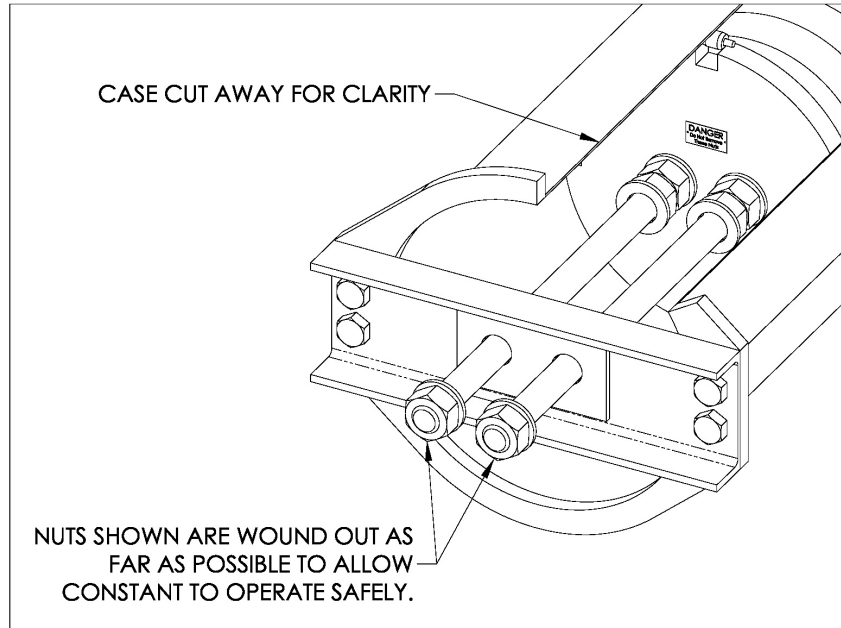


Figure 2.5 : Multi-lock assembly shown for BC50, BC51, BC53 & BC54
Multilock nuts are wound out to ends – Operational condition.

If the constant effort support is required to be removed from the pipe line OR a hydrostatic test is to be performed on the pipe, then the lever arm must first be locked in position. If the pre-set pin holes do not all line up for the pre-set pin to be used, then the multi-lock assembly can be used to lock the lever arm in position.

All that is required to lock the lever arm in position is the wind the multi-lock nuts up to the multi-lock channel. Once tightened by hand, the nuts are to be “snug” tightened with a spanner.

See Figures 2.6 to 2.10 showing examples of a “locked condition” and “operational condition” multi-locking devices.

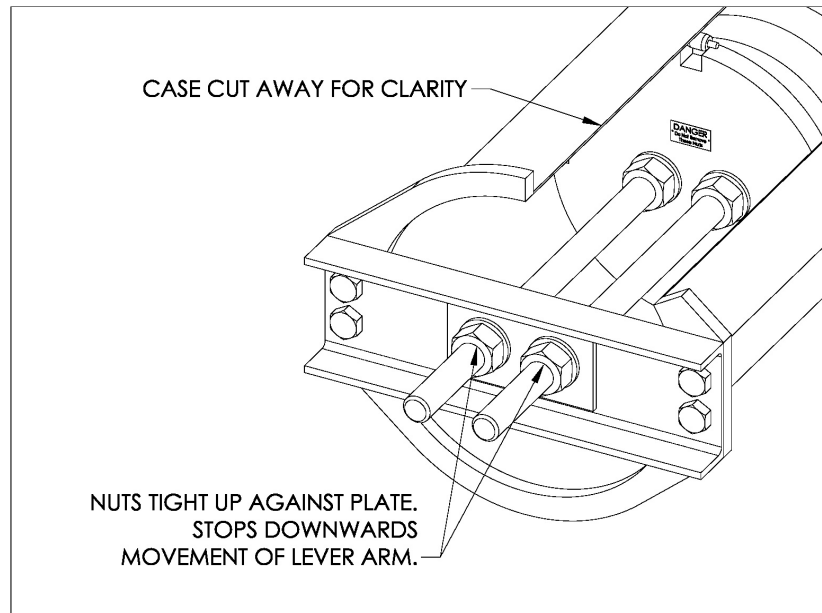


Figure 2.6 : Locked Condition - Multi-lock assembly shown for BC50, BC51, BC53 & BC54
Multilock nuts are wound up to the multi-lock channel.

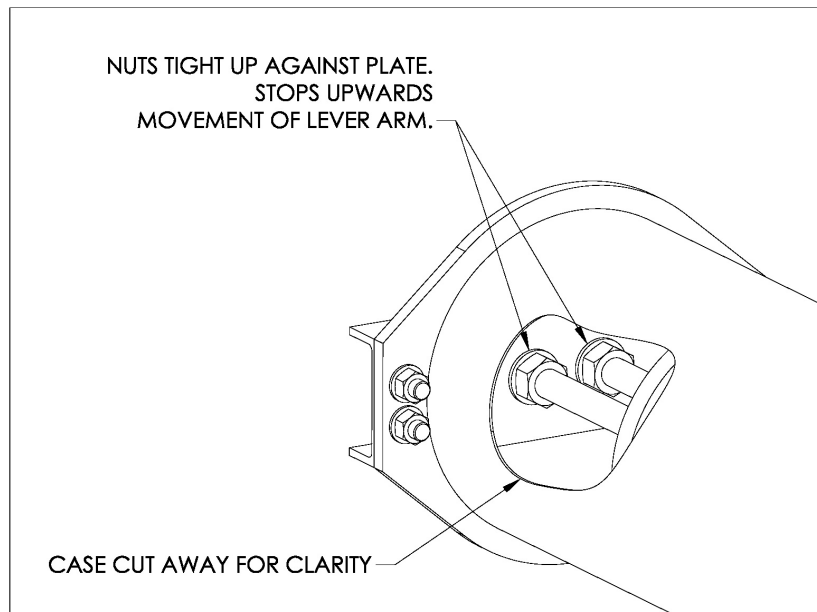


Figure 2.7 : Locked Condition - Multi-lock assembly shown for BC50, BC51, BC53 & BC54
Multilock nuts are wound up to the multi-lock channel.

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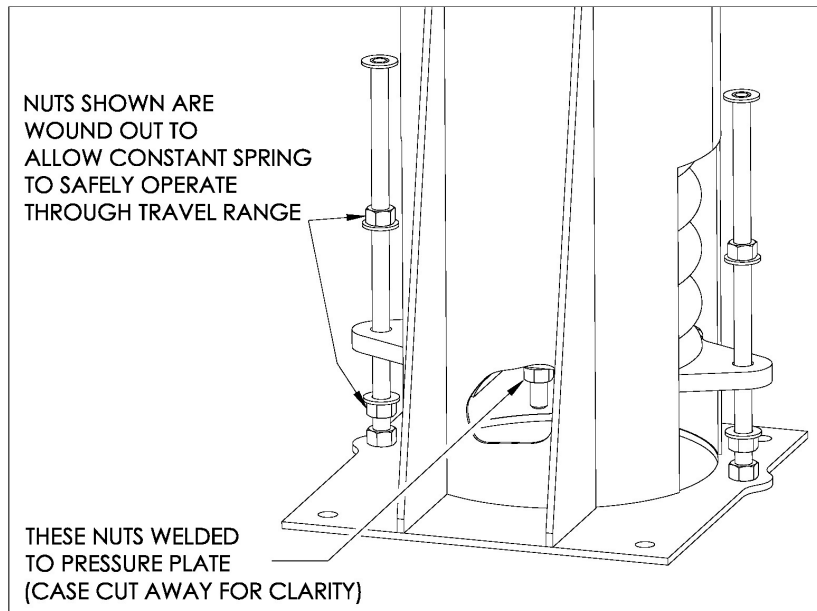


Figure 2.8 : Operational Condition – BC55 Multi-lock assembly.
Multilock nuts are wound out.

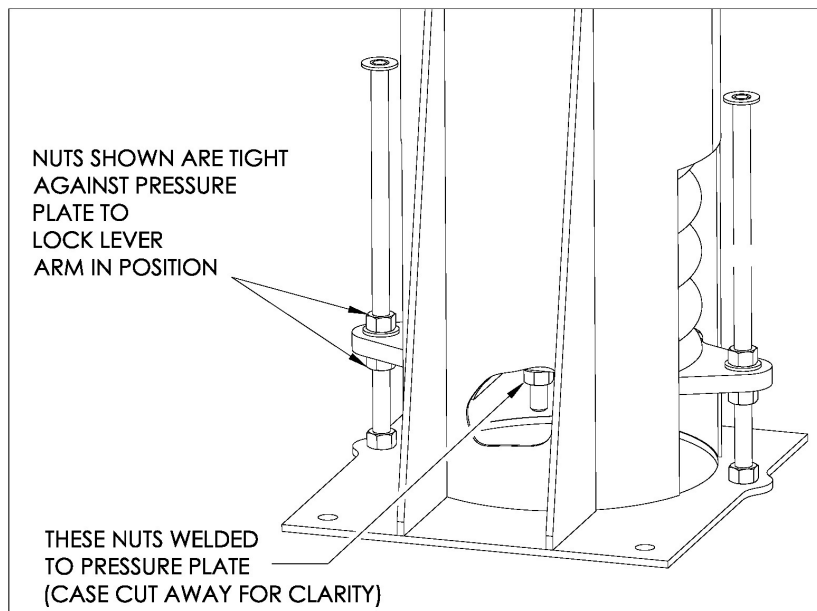


Figure 2.9 : Locked Condition – BC55 Multi-lock assembly.
Multilock nuts are wound up to the pressure plate.

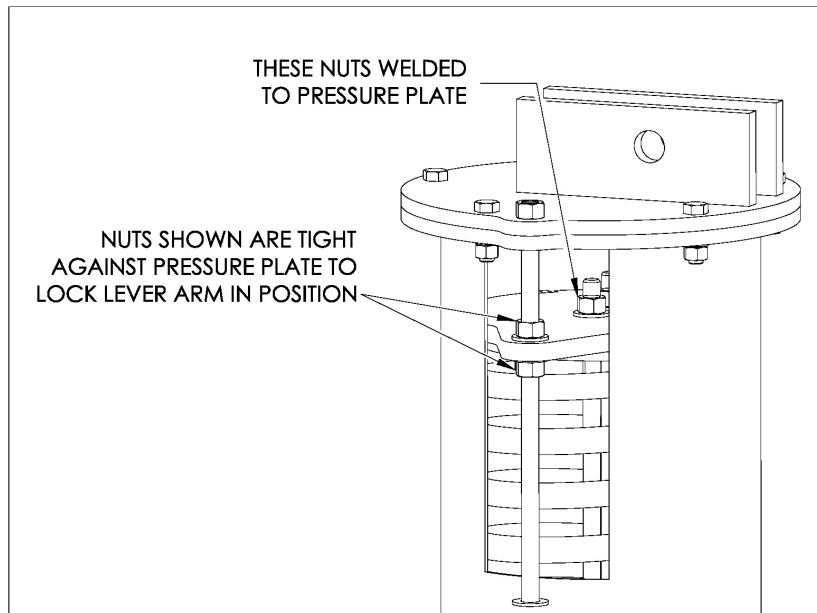


Figure 2.10 : Locked Condition – BC52 Multi-lock assembly.
Multilock nuts are wound up to the pressure plate.

END.