

**JACOB Tension Rods HMR 750 are manufactured with high process reliability on an automated production line. Each Tendon is labelled with a Data Matrix code which contains information such as rod length, thread lengths, rod marking and certification data. The information can be obtained by using the HMR app.**

## 1. Tendon Assembly

### **Factory pre-assembly M12 (1/2") - M36 (1-3/8")**

- All tendons up to M36 (1-3/8") are delivered pre-assembled in bundles.
- Tendons longer than 12m (39'4") are split into transportable lengths and will be pre-assembled up to a coupler or a turnbuckle.
- Tension Rods are set to the minimum thread engagement.
- Pins are packed separately in boxes.

### **M42 (1-5/8") – M100 (4")**

- Rods and fittings will be packed separately and site assembly will be required.  
All rods are color coded which allows easy identification of thread directions.
- Green marking placed on the front face of the rod and on packaging of fittings = RH thread
- Red marking placed on the front face of the rod and on packaging of fittings = LH thread

### **On-site tension rod assembly and installation**

- Prior to installation please check that all components are present and no damage has occurred.
- Assemble the lock covers on to the rod
- Assemble forks symmetrically and turn fork connectors equally until pin to pin length is set
- Swing the rod into place.
- Insert the pins through the fork heads and gusset plates (do not use any force i.e. a hammer)
  - Standard pin option: Pin with circlip
- Secure the circlips on the pins by using a circlip plier
  - Pin option 2: Pin with washer
- Secure the washers on to the pins by fastening the countersunk screw with an allen key.
- Tension and adjust the rod.

Tension Rod with spanner flat:

Place a spanner on the spanner flat and induce the load/adjustment required.

Tension Rod with no spanner flat:

For rods with no spanner flat, we recommend the use of a strap wrench.

Hydraulic Stressing:

Where large loads need to be induced the HMR pretension unit can be used. The equipment can be hired or bought from JACOB.

- Screw lock covers back against the forks, couplers, turnbuckles and cross couplers using a hook spanner with pin.

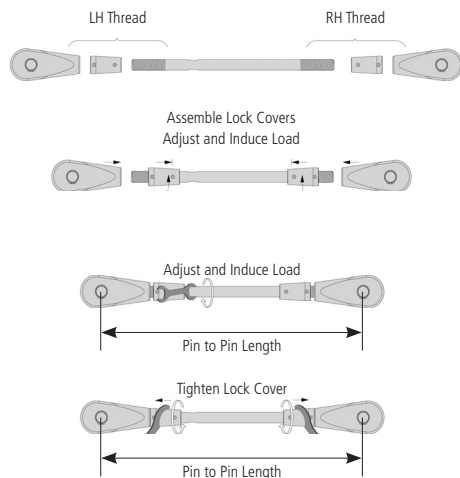
Note:

Galvanized or painted Tendons may be damaged by transport, handling and site installation. Any surface damage must be repaired.

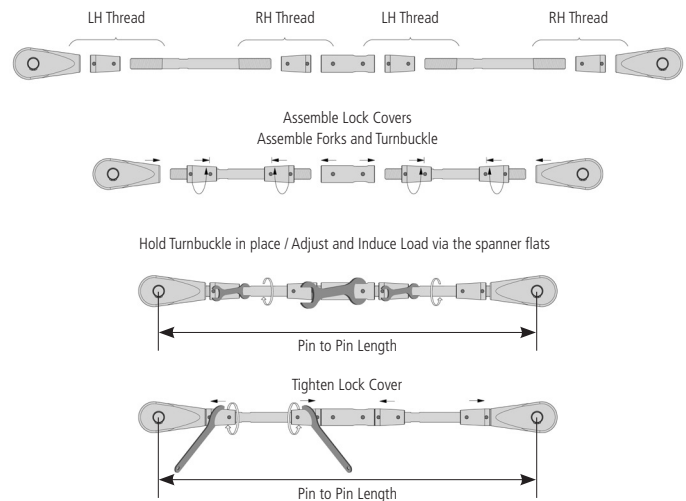
### Assembly Tools

| Thread-Ø |        | Rod |      | Turnbuckle |      | Pin with washer countersunk screw<br>DIN EN ISO 10642 |     |      | Lock Cover        |           |
|----------|--------|-----|------|------------|------|---|-----|------|-------------------|-----------|
| M        | Inch   | AF  |      | AF         |      | Size  | AF  |      | Biggest Ø / Pin Ø |           |
|          |        | mm  | Inch | mm         | Inch |   | mm  | Inch | mm                | Inch      |
| 12       | 1/2"   | 10  | 0,39 | 18         | 0,71 | M4 x 10   | 2,5 | 0,10 | 35/3              | 1.38/0.12 |
| 16       | 5/8"   | 13  | 0,51 | 23         | 0,91 | M5 x 10   | 3   | 0,12 | 35/3              | 1.38/0.12 |
| 20       | 3/4"   | 16  | 0,63 | 28         | 1,10 | M6 x 16   | 4   | 0,16 | 35/3              | 1.38/0.12 |
| 24       | 1"     | 20  | 0,79 | 32         | 1,26 | M6 x 16   | 4   | 0,16 | 35/3              | 1.38/0.12 |
| 30       | 1-1/4" | 25  | 0,98 | 41         | 1,61 | M6 x 16   | 4   | 0,16 | 60/4              | 2.36/0.16 |
| 36       | 1-3/8" | 30  | 1,18 | 50         | 1,97 | M6 x 16   | 4   | 0,16 | 60/4              | 2.36/0.16 |
| 42       | 1-5/8" | 36  | 1,42 | 60         | 2,36 | M8 x 20   | 5   | 0,20 | 60/4              | 2.36/0.16 |
| 48       | 2"     | 42  | 1,65 | 70         | 2,76 | M10 x 25  | 6   | 0,24 | 90/5              | 3.54/0.20 |
| 56       | 2-1/4" | 49  | 1,93 | 80         | 3,15 | M10 x 25  | 6   | 0,24 | 90/5              | 3.54/0.20 |
| 64       | 2-1/2" | 56  | 2,20 | 92         | 3,62 | M10 x25   | 6   | 0,24 | 155/6             | 6.10/0.24 |
| 76       | 3"     | 68  | 2,68 | 112        | 4,41 | M10 x 25  | 6   | 0,24 | 155/6             | 6.10/0.24 |
| 85       | 3-3/8" | 78  | 3,07 | 125        | 4,92 | M10 x 25  | 6   | 0,24 | 155/6             | 6.10/0.24 |
| 90       | 3-1/2" | 82  | 3,23 | 135        | 5,31 | M10 x 25  | 6   | 0,24 | 155/6             | 6.10/0.24 |
| 100      | 4"     | 91  | 3,58 | 150        | 5,91 | M10 x 25  | 6   | 0,24 | 155/6             | 6.10/0.24 |

### Tension Rod with Fork



### Assembly of Tension Rod with Turnbuckle

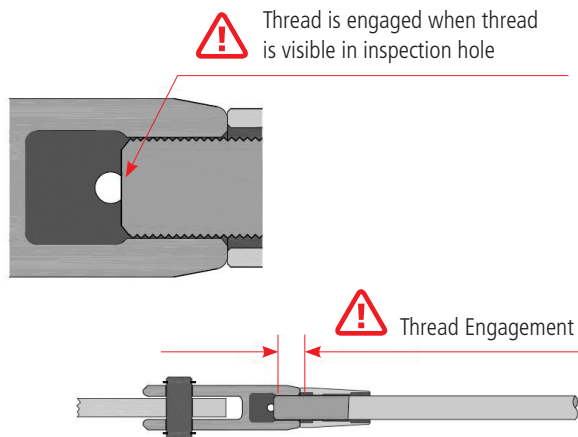


- Assemble the lock covers on to the rod
- Assemble forks and turnbuckle until the pin to pin length is set and note minimum thread engagement as shown in section 2.
- Swing the rod into place.
- Insert the pins through the fork heads and gusset plates (do not use any force i.e. a hammer)
- Hold turnbuckle in place. Adjust and torque the load symmetrically via the spanner flats on the rods. Thread engagement on forks and turnbuckle must always be ensured!
- Screw lock covers back against the forks and turnbuckle using a hook spanner with pin.

## 2. Minimum thread engagement

- All forks, turnbuckles and cross couplers are supplied with an inspection hole allowing easy control of minimum thread engagement.
- Thread is sufficiently engaged when the rod is visible in the opening of the fork, turnbuckle or cross coupler.
- Couplers are fitted with a thread stop to determine thread engagement.

### Fork example :



## 3. Corrosion Protection

The JACOB corrosion protection on rod threads guarantees 480 hours corrosion resistance in salt spray exposure and offers durability compliant to corrosivity category C3 high, therefore ensuring the same corrosion protection as the galvanized rod.

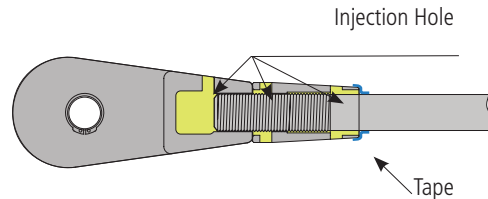
In order to avoid crevice corrosion which could occur if there is water retention in an unsealed thread, we recommend the use of the HMR sealant for any exterior applications.

In order to seal the thread area all tendons fitted with a fork and turnbuckle or cross coupler must be supplied with a lock cover. The sealant is then to be applied via the injection/inspection holes.

### Prior to sealant application:

- Check dow temperatures as per dow temperature datasheet.
- Remove any dirt and dust.
- Tape off the gap between the opening of the lock cover and rod.
- Remove tape after sealant is applied.

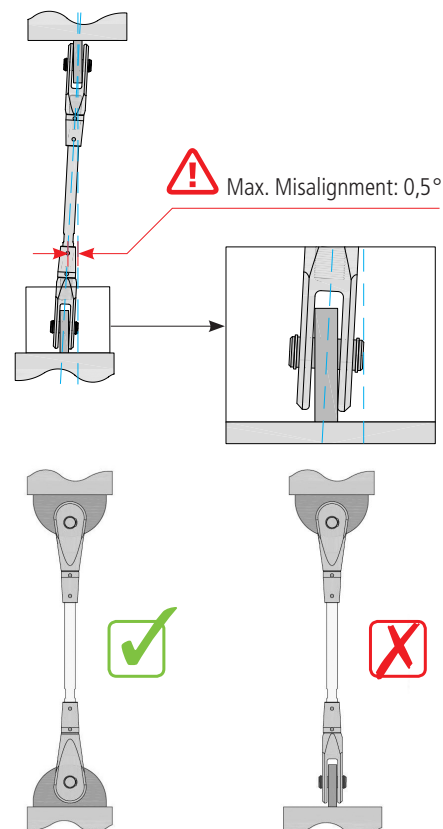
**No more tensioning or adjusting can be done after threads are sealed!**



Sealed off fork end connection.

## 4. Gusset Plate Misalignment

When installing the Tension Rod System ensure that the maximum misalignment does not exceed 0,5°. Forks should be kept in plane to each other as shown below. This prevents bending on the forks and gusset plates.



### Dew Point Temperature

This table shows at which surface temperature condensation occurs – depending on air temperature and relative humidity. For example: If air temperature is 20°C/68°F and relative humidity is 70 %, the dew point is at 14.4°C°/57.9°F.

No sealant should be applied if the surface temperature thermometer shows a value lower than +17,40°C/+63,3 °F (14,4°C + 3°C safety factor / 57.9°F + 37,4°F safety factor). The surface temperature thermometer is available to rent or to buy from JACOB.

| Air temperature |      | Dew temperatures in °C/°F and relative humidity levels |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|-----------------|------|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| °C              | °F   | 20%  |       | 25%   |       | 30%   |       | 35%   |       | 40%   |       | 45%   |       | 50%   |       | 55%   |       |
|                 |      | °C   | °F    | °C    | °F    | °C    | °F    | °C    | °F    | °C    | °F    | °C    | °F    | °C    | °F    | °C    | °F    |
| +2              | +36  | *  | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     |
| +4              | +39  | *  | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     |
| +6              | +43  | *  | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     |
| +8              | +46  | *  | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     |
| +10             | +50  | *  | *     | *     | *     | -6,0  | -42,8 | -4,2  | -39,6 | -2,6  | -36,7 | -1,2  | -34,2 | +0,1  | +32,2 | +1,4  | +34,5 |
| +12             | +54  | *  | *     | *     | *     | -4,5  | -40,1 | -2,6  | -36,7 | -1,0  | -33,8 | +0,4  | -32,7 | +1,9  | +35,4 | +3,2  | +37,8 |
| +14             | +57  | *  | *     | *     | *     | -2,9  | -37,2 | -1,0  | -33,8 | +0,6  | -33,1 | +2,3  | -36,1 | +3,7  | +38,7 | +5,1  | +41,2 |
| +15             | +59  | *  | *     | *     | *     | -2,2  | -36,0 | -0,3  | -32,5 | +1,5  | -34,7 | +3,2  | -37,8 | +4,7  | +40,5 | +6,1  | +43,0 |
| +16             | +61  | *  | *     | *     | *     | -1,4  | -34,5 | +0,5  | -32,9 | +2,4  | -36,3 | +4,1  | -39,4 | +5,6  | +42,1 | +7,0  | +44,6 |
| +17             | +63  | *  | *     | *     | *     | -0,6  | -33,1 | +1,4  | -34,5 | +3,3  | -37,9 | +5,0  | -41,0 | +6,5  | +43,7 | +7,9  | +46,2 |
| +18             | +64  | *  | *     | *     | *     | +0,2  | -32,4 | +2,3  | -36,1 | +4,2  | -39,6 | +5,9  | -42,6 | +7,4  | +45,3 | +8,8  | +47,8 |
| +19             | +66  | *  | *     | *     | *     | +1,1  | -34,0 | +3,2  | -37,8 | +5,1  | -41,2 | +6,8  | -44,2 | +8,3  | +46,9 | +9,8  | +49,6 |
| +20             | +68  | *  | *     | *     | *     | +1,9  | -35,4 | +4,1  | -39,4 | +6,0  | -42,8 | +7,7  | -45,9 | +9,3  | +48,7 | +10,7 | +51,3 |
| +21             | +70  | *  | *     | +0,3  | +32,5 | +2,8  | -37,0 | +5,0  | -41,0 | +6,9  | -44,4 | +8,6  | -47,5 | +10,2 | +50,4 | +11,6 | +52,9 |
| +22             | +72  | *  | *     | +1,1  | +34,0 | +3,7  | -38,7 | +5,9  | -42,6 | +7,8  | -46,0 | +9,5  | -49,1 | +11,1 | +52,0 | +12,5 | +54,5 |
| +23             | +73  | *  | *     | +1,9  | +35,4 | +4,5  | -40,1 | +6,7  | -44,1 | +8,7  | -47,7 | +10,4 | -50,7 | +12,0 | +53,6 | +13,5 | +56,3 |
| +24             | +75  | *  | *     | +2,8  | +37,0 | +5,4  | -41,7 | +7,6  | -45,7 | +9,6  | -49,3 | +11,3 | -52,3 | +12,9 | +55,2 | +14,4 | +57,9 |
| +25             | +77  | +0,5   | +32,9 | +3,6  | +38,5 | +6,2  | -43,2 | +8,5  | -47,3 | +10,5 | -50,9 | +12,2 | -54,0 | +13,9 | +57,0 | +15,3 | +59,5 |
| +26             | +79  | +1,3   | +34,3 | +4,5  | +40,1 | +7,1  | -44,8 | +9,4  | -48,9 | +11,4 | -52,5 | +13,2 | -55,8 | +14,8 | +58,6 | +16,3 | +61,3 |
| +28             | +82  | +3,0   | +37,4 | +6,1  | +43,0 | +8,8  | -47,8 | +11,1 | -52,0 | +13,1 | -55,6 | +15,0 | -59,0 | +16,6 | +61,9 | +18,1 | +64,6 |
| +30             | +86  | +4,6   | +40,3 | +7,8  | +46,0 | +10,5 | -50,9 | +12,9 | -55,2 | +14,9 | -58,8 | +16,8 | -62,2 | +18,4 | +65,1 | +20,0 | +68,0 |
| +32             | +90  | +6,2   | +43,2 | +9,5  | +49,1 | +12,2 | -54,0 | +14,6 | -58,3 | +16,7 | -62,1 | +18,6 | -65,5 | +20,3 | +68,5 | +21,8 | +71,2 |
| +35             | +95  | +8,7   | +47,7 | +12,0 | +53,6 | +14,8 | -58,6 | +17,2 | -63,0 | +19,4 | -66,9 | +21,3 | -70,3 | +23,0 | +73,4 | +24,6 | +76,3 |
| +40             | +104 | +12,8  | +55,0 | +16,2 | +61,2 | +19,1 | -66,4 | +21,6 | -70,9 | +23,8 | -74,8 | +25,8 | -78,4 | +27,6 | +81,7 | +29,2 | +84,6 |

| °C  | °F   | 60%   |       | 65%   |       | 70%   |       | 75%   |       | 80%   |       | 85%   |       | 90%   |        | 95%   |       |
|-----|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|
|     |      | °C    | °F    | °C    | °F    | °C    | °F    | °C    | °F    | °C    | °F    | °C    | °F    | °C    | °F     | °C    | °F    |
| +2  | +36  | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | *     | +0,5  | +32,9  | +1,3  | 34,34 |
| +4  | +39  | *     | *     | *     | *     | *     | *     | +0,0  | +0,0  | +0,9  | +33,6 | +1,7  | +35,1 | +2,5  | +36,5  | +3,3  | 37,94 |
| +6  | +43  | *     | *     | *     | *     | +1,0  | +33,8 | +1,9  | +35,4 | +2,8  | +37,0 | +3,7  | +38,7 | +4,5  | +40,1  | +5,3  | 41,54 |
| +8  | +46  | +0,7  | +33,3 | +1,9  | +35,4 | +2,9  | +37,2 | +3,9  | +39,0 | +4,8  | +40,6 | +5,6  | +42,1 | +6,5  | +43,7  | +7,3  | 45,14 |
| +10 | +50  | +2,6  | +36,7 | +3,7  | +38,7 | +4,8  | +40,6 | +5,8  | +42,4 | +6,7  | +44,1 | +7,6  | +45,7 | +8,4  | +47,1  | +9,2  | 48,56 |
| +12 | +54  | +4,5  | +40,1 | +5,7  | +42,3 | +6,7  | +44,1 | +7,7  | +45,9 | +8,7  | +47,7 | +9,6  | +49,3 | +10,4 | +50,7  | +11,2 | 52,16 |
| +14 | +57  | +6,4  | +43,5 | +7,5  | +45,5 | +8,6  | +47,5 | +9,6  | +49,3 | +10,6 | +51,1 | +11,5 | +52,7 | +12,4 | +54,3  | +13,2 | 55,76 |
| +15 | +59  | +7,3  | +45,1 | +8,5  | +47,3 | +9,6  | +49,3 | +10,6 | +51,1 | +11,6 | +52,9 | +12,5 | +54,5 | +13,4 | +56,1  | +14,2 | 57,56 |
| +16 | +61  | +8,2  | +46,8 | +9,4  | +48,9 | +10,5 | +50,9 | +11,6 | +52,9 | +12,6 | +54,7 | +13,5 | +56,3 | +14,4 | +57,9  | +15,2 | 59,36 |
| +17 | +63  | +9,2  | +48,6 | +10,4 | +50,7 | +11,5 | +52,7 | +12,5 | +54,5 | +13,5 | +56,3 | +14,5 | +58,1 | +15,3 | +59,5  | +16,2 | 61,16 |
| +18 | +64  | +10,1 | +50,2 | +11,3 | +52,3 | +12,5 | +54,5 | +13,5 | +56,3 | +14,5 | +58,1 | +15,4 | +59,7 | +16,3 | +61,3  | +17,2 | 62,96 |
| +19 | +66  | +11,1 | +52,0 | +12,3 | +54,1 | +13,4 | +56,1 | +14,5 | +58,1 | +15,5 | +59,9 | +16,4 | +61,5 | +17,3 | +63,1  | +18,2 | 64,76 |
| +20 | +68  | +12,0 | +53,6 | +13,2 | +55,8 | +14,4 | +57,9 | +15,4 | +59,7 | +16,4 | +61,5 | +17,4 | +63,3 | +18,3 | +64,9  | +19,2 | 66,56 |
| +21 | +70  | +12,9 | +55,2 | +14,2 | +57,6 | +15,3 | +59,5 | +16,4 | +61,5 | +17,4 | +63,3 | +18,4 | +65,1 | +19,3 | +66,7  | +20,2 | 68,36 |
| +22 | +72  | +13,9 | +57,0 | +15,1 | +59,2 | +16,3 | +61,3 | +17,4 | +63,3 | +18,4 | +65,1 | +19,4 | +66,9 | +20,3 | +68,5  | +21,2 | 70,16 |
| +23 | +73  | +14,8 | +58,6 | +16,1 | +61,0 | +17,2 | +63,0 | +18,3 | +64,9 | +19,4 | +66,9 | +20,3 | +68,5 | +21,3 | +70,3  | +22,2 | 71,96 |
| +24 | +75  | +15,8 | +60,4 | +17,0 | +62,6 | +18,2 | +64,8 | +19,3 | +66,7 | +20,3 | +68,5 | +21,3 | +70,3 | +22,3 | +72,1  | +23,1 | 73,58 |
| +25 | +77  | +16,7 | +62,1 | +18,0 | +64,4 | +19,1 | +66,4 | +20,3 | +68,5 | +21,3 | +70,3 | +22,3 | +72,1 | +23,2 | +73,8  | +24,1 | 75,38 |
| +26 | +79  | +17,6 | +63,7 | +18,9 | +66,0 | +20,1 | +68,2 | +21,2 | +70,2 | +22,3 | +72,1 | +23,3 | +73,9 | +24,2 | +75,6  | +25,1 | 77,18 |
| +28 | +82  | +19,5 | +67,1 | +20,8 | +69,4 | +22,0 | +71,6 | +23,2 | +73,8 | +24,2 | +75,6 | +25,2 | +77,4 | +26,2 | +79,2  | +27,1 | 80,78 |
| +30 | +86  | +21,4 | +70,5 | +22,7 | +72,9 | +23,9 | +75,0 | +25,1 | +77,2 | +26,2 | +79,2 | +27,2 | +81,0 | +28,2 | +82,8  | +29,1 | 84,38 |
| +32 | +90  | +23,3 | +73,9 | +24,6 | +76,3 | +25,8 | +78,4 | +27,0 | +80,6 | +28,1 | +82,6 | +29,2 | +84,6 | +30,2 | +86,4  | +31,1 | 87,98 |
| +35 | +95  | +26,1 | +79,0 | +27,4 | +81,3 | +28,7 | +83,7 | +29,9 | +85,8 | +31,0 | +87,8 | +32,1 | +89,8 | +33,1 | +91,6  | +34,1 | 93,38 |
| +40 | +104 | +30,7 | +87,3 | +32,1 | +89,8 | +33,5 | +92,3 | +34,7 | +94,5 | +35,9 | +96,6 | +37,0 | +98,6 | +38,0 | +100,4 | +39,0 | 102,2 |

\* no formation of condensation