

ASSEMBLY INSTRUCTIONS

for friction type engine stays


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| PC-Drawing | | | | Dimension for friction type engine stays | | | | | | |
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1 Introduction

Engine stays are installed where countermeasures against dynamic effects are necessary. Guidance is given in the MIM (Marine Installation Manual), chapter Engine Dynamics and by the Engine Dynamic data sheet "Countermeasures for dynamic effects". The engine stays positions are defined in the relevant MIDS "DG9715 – Engine Stays" and/or in the "Platform Outline Views".

NOTE

This assembly instruction is only valid for installation of friction type stays according to WinGD design. This stays type must be only installed in longitudinal direction. In lateral direction only the use of "hydraulic type" stays is admissible. If other engine stays types are installed, the instruction of the relevant supplier must be followed.

2 Functional description

The engine stays of friction type transmit longitudinal forces from the engine via friction shims and sheet metal girders to the ship hull. The clamping force of the two clamping bolts is adjusted in such a way that during engine operation the engine's pulsating forces are transmitted to the ship hull. During loading and unloading, the stay is able to adapt the deformations of the ship's hull within its stroke. To reduce material stress in the stay itself and in the attachment points, hinge pins are considered in the supports to allow movements in both vertical and longitudinal directions.

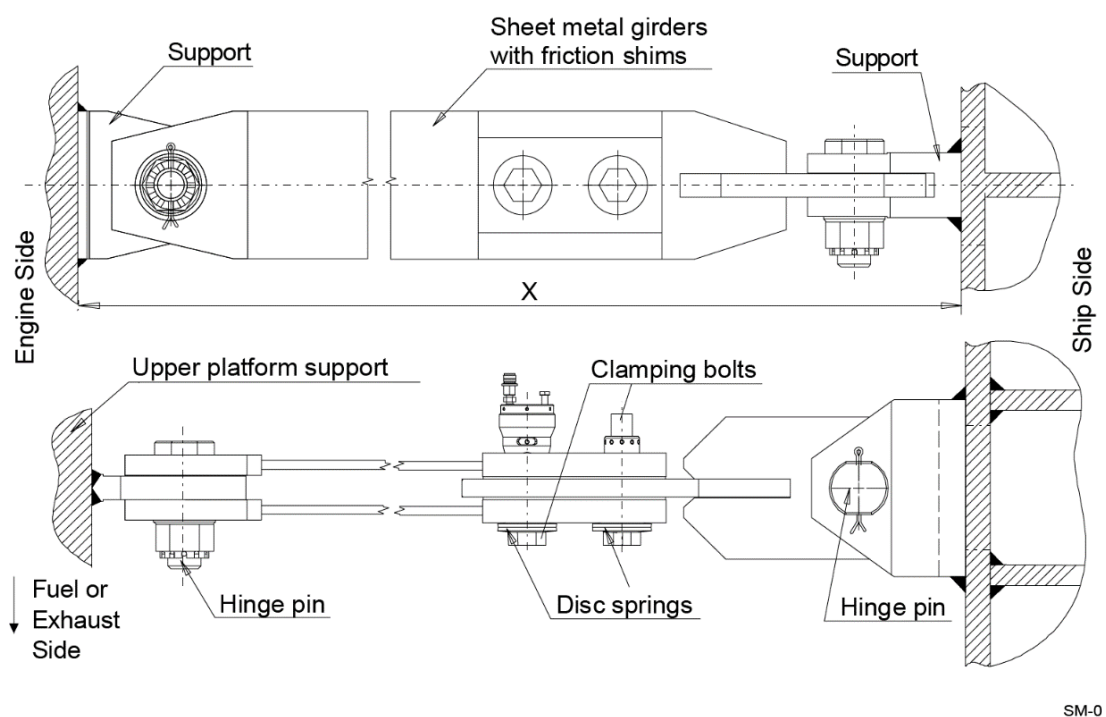


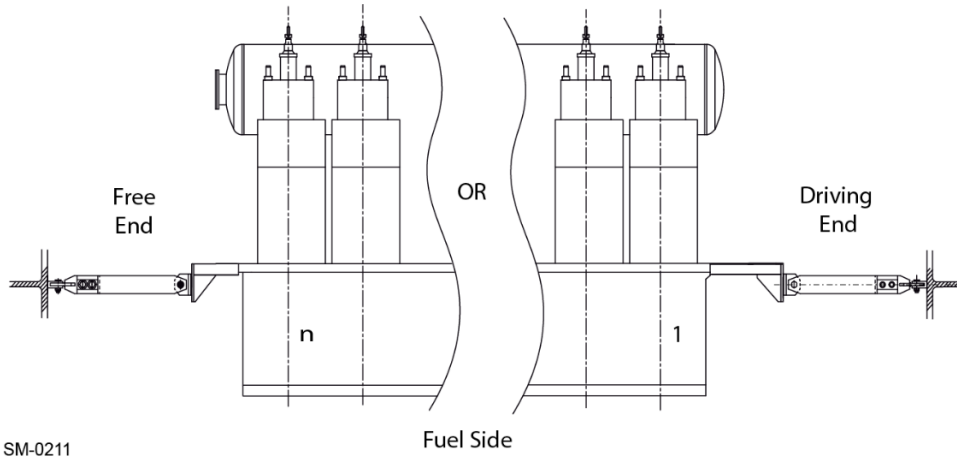
Figure 1: Friction stay assembly parts.

NOTE

To ensure an appropriate function and to prolong the lifetime of the components it is vital that the engine stays components are selected according to WinGD's specification and assembled correctly. A wrong installation can even lead to cracks in the support point on engine and ship hull side.

3 Engine Stays arrangement

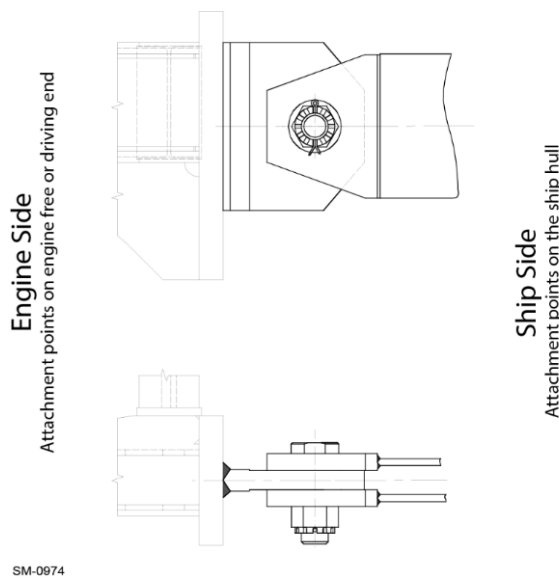
The engine stays are installed either on engine's free end or driving end side between the engine and the ship hull (see Figure 2).



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Figure 2: Longitudinal stays arrangement

The support points on the ship hull side must be prepared by the shipyard. They must meet WinGD's requirement regarding stiffness and permissible forces, as defined in the relevant MIDS" DG9715 – Engine Stays". The support points on the engine side are already prepared by the engine builder accordingly. Figure 3 shows an example of such a support point on engine platform side. The actual engine and platform specific layout and engine stays positions are specified in the corresponding MIDS" DG9715 – Engine Stays" and in the Platform Outline View.



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Figure 3: Support point on platform side for longitudinal engine stays

4 Fitting of the stays

4.1 Starting conditions

Before fitting the engine stays, the following conditions must be fulfilled:

- Ship is afloat
- Engine is fully aligned
- Epoxy resin had been poured and is fully cured.
- Engine is coupled to the intermediate shaft
- Engine foundation bolts are fully tightened
- Engine side stoppers are fitted
- Engine is preheated to starting condition
- The relevant installation drawings are available.
- The attachment points of the engine stays on engine and ship hull side are marked in the final position according to the relevant MIDS" DG9715 – Engine Stays" and/or Platform Outline View.
- The hydraulic tensioning device is ready for use. As the clamping bolt nuts are of the same size as the nuts of the foundation bolts, the same hydraulic tensioning device, which is included in the engine tool kit (code no. 94145), can be used for pre-tensioning.

NOTE

When fitting the engine stays it is very important that the engine is preheated to starting condition. This is necessary to reduce any possible misalignment of the engine stay due to engine thermal expansion between fitting and service condition. Excessive horizontal and vertical misalignment of the engine stay between the engine's and the ship's attachment points may restrict the stay's function. It may even lead to buckling or cracking of the stay. For admissible tolerances refer to table 2. During positioning and fitting use a crane to avoid overstress to the engine stay.

4.2 Installation steps

1. Prepare all parts and installation tools.
2. Make sure that all starting conditions according to chapter 4.1 are fulfilled.
3. Assemble the engine stays according to the relevant installation drawing of design group 9715 and tighten the clamping bolts slightly by hand.
4. Move the stay until the nominal position (defined by the distance M in Table 2) is achieved. Then tighten the clamping bolts with 100 bar pressure.
5. Check at the marked attachment points on ship hull and engine side that there is no platform support, piping or something else which could collide with the stay. In particular pay attention to the space requirements of the hydraulic tensioning device in order to allow proper tightening of the clamping bolts.
6. Put the engine stays in the final position between ship hull and engine and align the stay's support without fixing on engine side. Check whether the stay is longer, shorter or equal in relation to the clear width between engine and ship hull.
 - In case the stay is **longer** than the clear width between ship hull and engine, measure its overall length X. Then measure the clear width between ship hull and engine and calculate the difference to the overall stay length X.
 - If the difference exceeds the maximum allowed value limited by the tolerances in Table 2, the support on the engine side must be shortened and the edges must be prepared for welding.
 - In case the stay is **shorter** than the clear width between ship hull and engine, measure the gap between stay end and ship hull directly.
 - If the gap exceeds the maximum allowed value limited by the tolerances in table 3, a steel plate has to be added as spacer under the support to compensate the undersize.
 - In case stay's length is equal to the clear width between ship hull and engine, no modifications are necessary.

NOTE

7. During loading, the ship's hull tends to deform towards the ship's centerline, respectively to engine side. Therefore, it is suggested to fit a stay of a length just correct or rather 'too short' than with over-length, in order to allow an extra stroke in longitudinal direction (see table 3).

8. Make sure that the surfaces of the platform support and the ship side attachment points are clean.

9. Attach the stay on engine side in the final position and fix the support by spot welding.
10. Align the stay horizontally and vertically (observe the tolerances given in Table 3) and fix the support on ship hull side by spot welding.
11. Before accomplishing the final welding, loosen the clamping bolts in order to avoid material stress due to thermal expansion.
12. Perform final welding at the supports on engine and ship hull side.
13. After all parts have cooled down, tighten the clamping bolts with the final pressure according to the values as specified in the below Table 1.

Table 1 : Pre-tensioning pressure

| Engine type | Hydraulic pre-tensioning pressure (bar) |
|--|---|
| W-X35-B | 230 |
| W-X40-B/DF-1.0 | 250 |
| RT-flex50-B/-D/DF | 310 |
| W-X52/DF/DF-1.1/DF-2.1 W-X52DF-M-1.0/DF-A-1.0 W-X52-S2.0/DF-S1.0/DF-S2.0 W-X52DF-M-S1.0/DF-A-S1.0 | 280 |
| W-X62-B/DF/DF-1.1/DF-2.1 W-X62DF-M-1.0/DF-A-1.0 W-X62-S2.0/DF-S1.0/DF-S2.0 W-X62DF-M-S1.0/DF-A-S1.0 | 170 |
| W-X72-B/DF/DF-1.1/DF-2.1 W-X72DF-M-1.0/DF-A-1.0 W-X72DF-1.2/DF-2.2 | 190 |

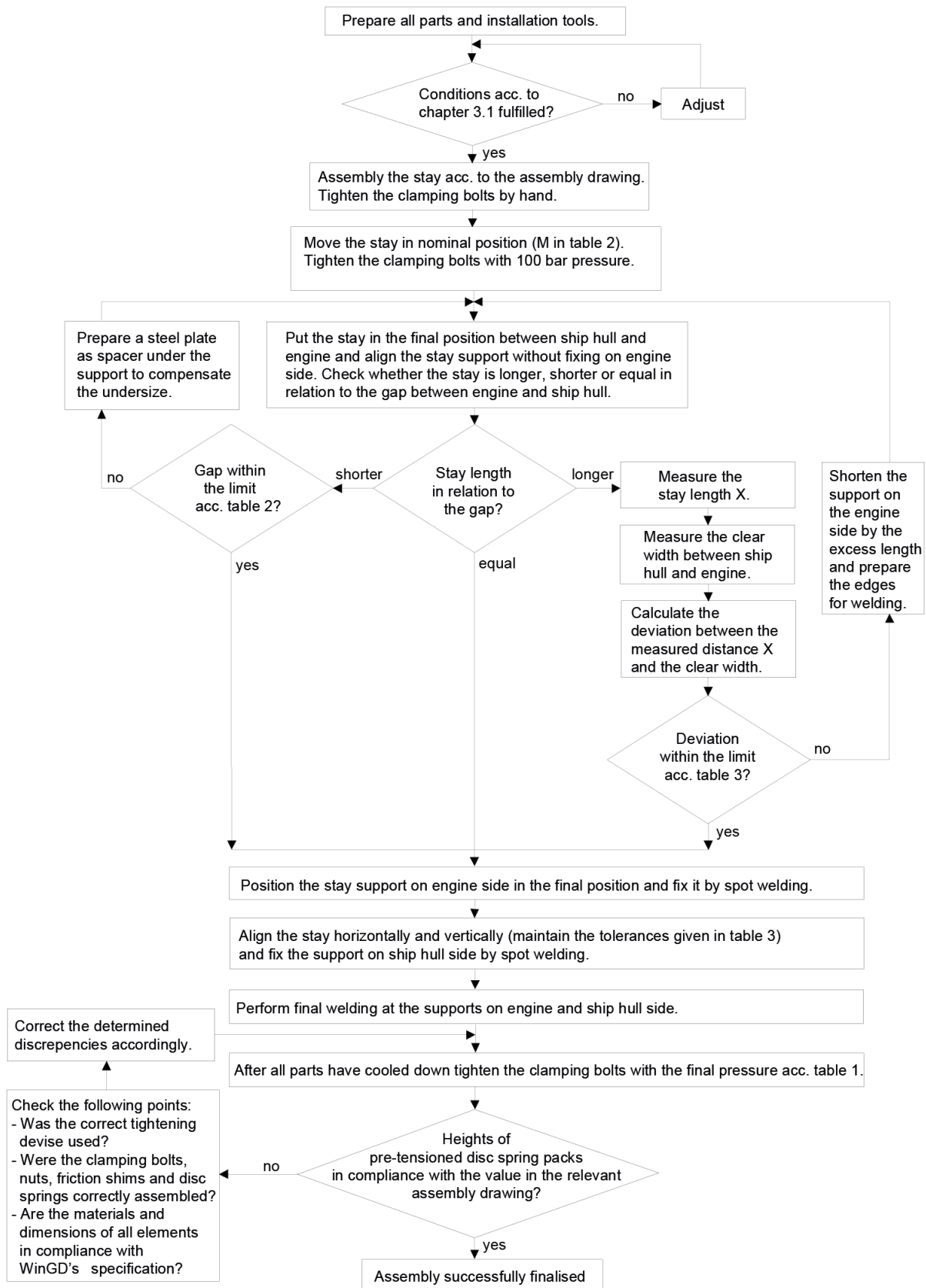
14. Measure the height of each pre-tensioned disc spring pack and check with the relevant MIDS "DG9715 – Engine Stays, Disc Spring" and in the Platform Outline View whether the height is according to WinGD's specifications.

If the height deviates from the given value the following need to be checked:

- Was the correct tensioning device used for tensioning the clamping bolts?
 - In case a too small tensioning device was used, re-tighten the clamping bolts with the correct device and given pressure.
 - In case a too big tensioning device was used, calculate whether the maximum permissible yield strength of the clamping bolts, nuts, friction shims and disc springs was already exceeded, and the elements need to be replaced due to damage by plastic deformation. Even if the calculation result indicates that the maximum permissible yield strength was not exceeded, make finally a visual check to ensure that no element was damaged due to the wrong tensioning.

- Were the clamping bolts, nuts, friction shims and disc springs correctly assembled according to the relevant assembly drawing?
 - In case one or more elements were wrong assembled, re-arrange those accordingly.

- Are the material and dimensions of all elements in compliance with WinGD's specifications?
 - In case the material or dimensions of one or more elements are not according to WinGD's specifications replace those accordingly.



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Figure 3: Engine stay installation process diagram

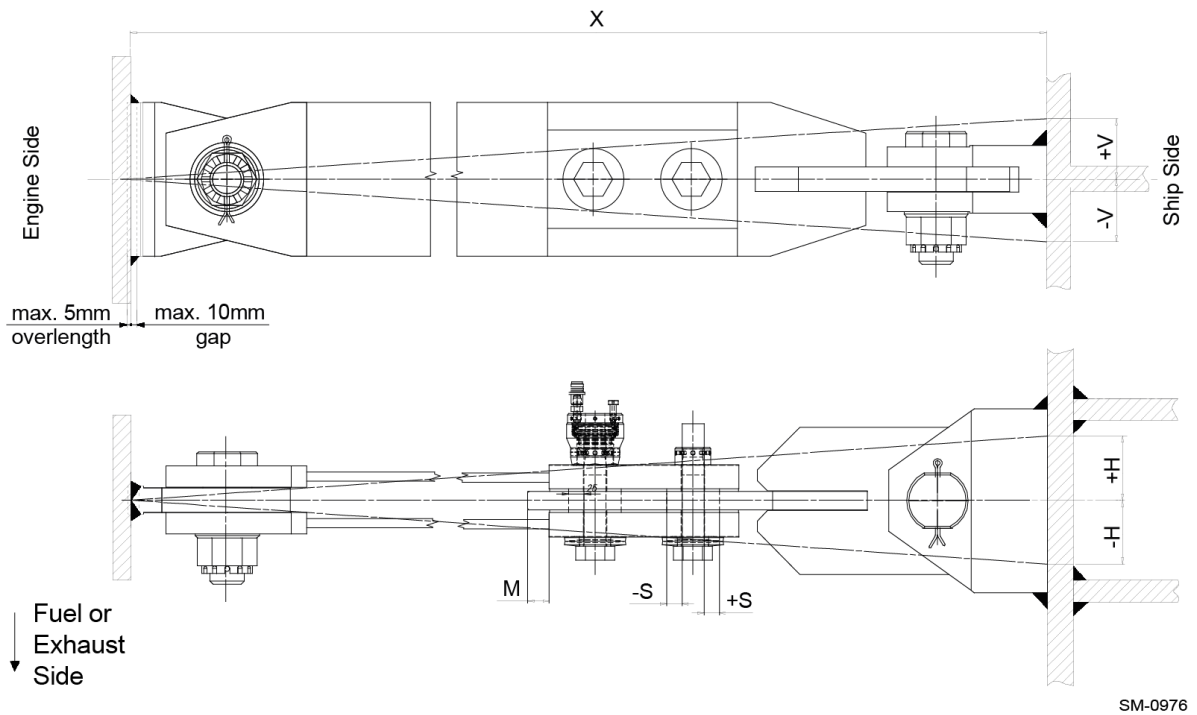


Figure 4 : Stays assembly tolerances

Table 2 : Admissible deviation of the stay length during commissioning

| | Deviation of stay length X related to clear width | Reference | Resulting stroke | |
|----------------------------------|---|-----------|------------------|-------------|
| | | M | -S | +S |
| Nominal position | 0 | 25 | 24.5 | 24.5 |
| Stay too long (max. over length) | +5 | 30 | 29.5 | 19.5 |
| Stay too short (max. gap) | -10 | 15 | 14.5 | 34.5 |

Table 3 : Admissible vertical and horizontal deviation in stay's alignment during commissioning

| Clear width X | Lateral application | | | | Longitudinal application | | | |
|---------------|---------------------|----|-----|----|--------------------------|----|-----|-----|
| | +V | -V | +H | -H | +V | -V | +H | -H |
| 2000 to 2280 | 2 | 0 | 1.5 | 0 | 2 | 0 | 1.5 | 1.5 |
| 2281 to 2560 | 2 | 0 | 2 | 0 | 2 | 0 | 2 | 2 |
| 2561 to 3120 | 4 | 0 | 3 | 0 | 4 | 0 | 3 | 3 |
| 3121 to 3400 | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 4 |

5 Operational check and final adjustment

5.1 During sea trial

During service check whether relative movements between the ship side attachment device and the sheet metal girders occur.

If this is the case, the following might be the cause:

- Insufficient or incorrect tightening of the clamping bolts
- Dirty or damaged friction shims
- Material or quality of friction shims is not according to WinGD's specification.
- Incorrect assembly of the stays
- Incorrect fitting or alignment

5.2 After sea trial

After sea trial, when the engine and machinery space are still in hot condition, check whether measure 'M' remained within the limits given in Table 4 and check also whether the stays are still in line with the engine (horizontally and vertically). If not, it may help to loosen the clamping bolts. The sheet metal girders can then move within the clearance of the through holes of the ship side attachment device. Undesirable tension in the stay can release and possible misalignment may be compensated.

At a later stage, when the vessel has been loaded and unloaded, check whether a displacement between engine and ship hull has taken place to make sure the stays work properly. Check also whether measure 'M' remained within the limits given in Table 4. If this is not the case, refer to the possible causes listed under 5.1 in

For maintenance repeat the above mentioned checks i.e. check the pretension of the bolts at intervals as scheduled for the maintenance of the engine holding down studs.

Table 4 : Admissible deviation of the stay length in service

| | Reference M (mm) | Loaded state |
|------------------|------------------------|-------------------|
| absolute minimum | 2 | ballast condition |
| absolute maximum | 48 | fully loaded |