6.1 GENERAL SPECIFICATION FOR DESIGN & INSTALLATION OF ILA'S (Sample)

6.1.1 PURPOSE. The lifting and handling specifications herein shall control the design, documentation and certification of general purpose service equipment being manufactured for PNS. This specification is derived primarily from the requirements of the Lifting & Handling Manual for integral lifting attachments.

6.1.2 DEFINITIONS

6.1.2.1 Integral Lifting Attachment (ILA). An ILA is a lifting attachment that is fabricated or formed as an integral part (i.e. permanently attached to) the component or equipment to be lifted. Examples of an ILA include:

6.1.2.1.1 A padeye

6.1.2.1.2 A hole cut in the structure

6.1.2.1.3 A threaded hole

6.1.2.1.4 A welded block of material attached to add a threaded hole

6.1.2.2 Unit. The item or load being lifted to which ILAs are permanently mounted.

6.1.2.3 PNS. Portsmouth Naval Shipyard

6.1.2.4 Contractor. The entity fabricating the Unit.

6.1.2.5 Designer. The qualified engineer or entity designing the Unit including the ILA installation to the Unit.

6.1.2.6 Base of Support. That portion of the Unit's structure that contacts the ground and supports the Unit when the Unit is on the ground (i.e., footprint).

6.1.2.7 Qualified Engineer. An engineer who is competent in the practice of structural and/or mechanical engineering as a result of education and experience.

6.1.2.8 Working Load Limit (WLL). The maximum allowable load that can be applied to a designed structural component without infringing on its safety factors defined herein, aka: design capacity.

6.1.3 GENERAL

6.1.3.1 Any deviations to this specification that pertain to ILAs or other crane lifting and handling related functions must be approved in writing by PNS, with concurrence from the PNS Lifting and Handling Department Technical Division (Code 710).

6.1.3.2 A lifting plan that includes a diagram for lifting the Unit shall be provided by the Designer/Contractor and must be approved by PNS prior to fabrication of the unit, with concurrence from the PNS Lifting and Handling Department Technical Division (Code 710). This plan shall include the Unit's weight (empty weight and full weight, if applicable), center of gravity location, ILA details and the locations of each ILA. The plan shall also include any basic lifting restrictions and any special allowances, including, but not limited to, minimum sling length, minimum sling capacity, or allowance for out-of-plane pulling on padeyes (if applicable), etc.

6.1.3.3 Threaded holes intended to be used as ILAs shall not be lubricated and shall be protected by removable threaded plugs or similar when not in use.

6.1.3.4 The padeye is the preferred ILA and it should be used when possible, provided it can be incorporated into the design of the Unit in a practical way. Examples of padeyes and the preferred rigging configuration using padeyes are provided in figures 1 and 2.

6.1.3.5 Material used for the purposes of manufacturing an ILA shall be steel or aluminum.

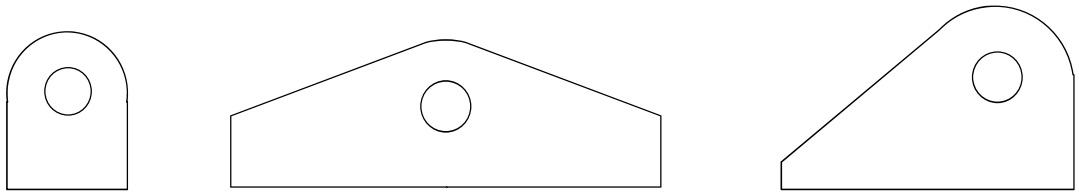

Figure 1: Typical Padeyes

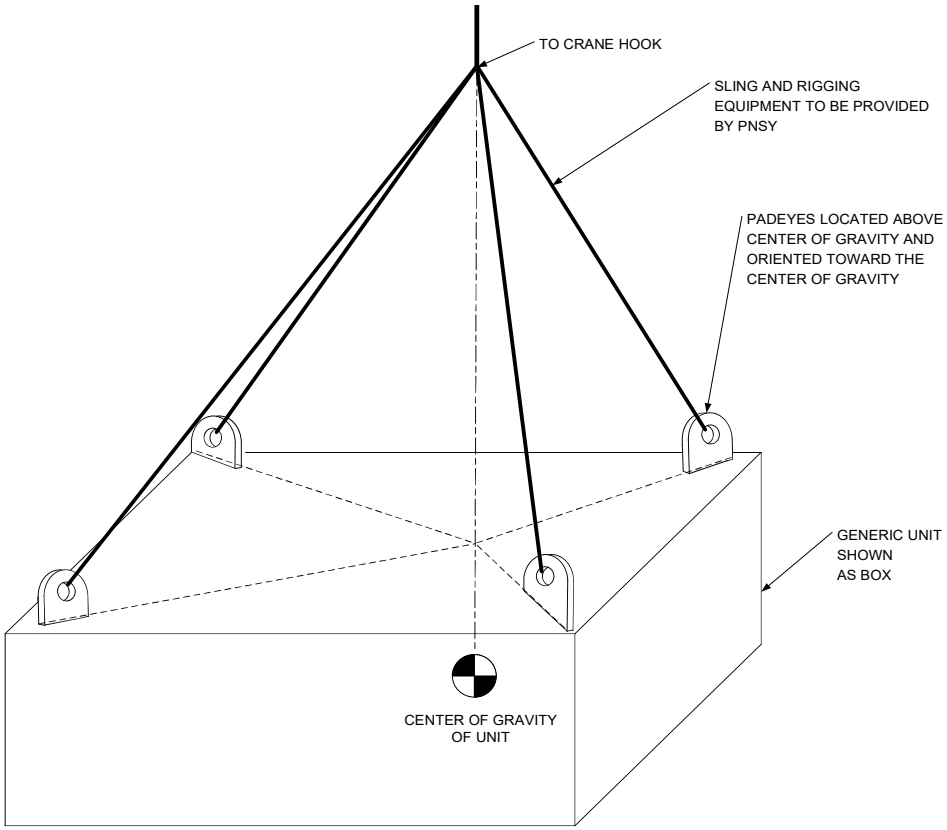

Figure 2: Standard (Preferred) Lifting Configuration

6.1.4 MARKING

6.1.4.1 The total weight (empty and full, if applicable) of the Unit shall be permanently marked on each side of the Unit with 2-inch high lettering (or larger) with a contrasting color from the Unit (yellow unacceptable).

6.1.4.2 Each ILA shall be permanently identified with its Working Load Limit (WLL), [e.g., WLL=10,000 LB] by stamping, etching or by placing on a permanently attached label plate.

6.1.4.3 Any ILA receiving a load test shall also be permanently marked with the test date (i.e., by stamping, etching or by placing on a permanently attached label plate).

6.1.4.4 The lifting plan with diagram shall be displayed on an 8in x 10in minimum sized placard attached to the unit.

6.1.5 PLACEMENT

6.1.5.1 ILAs shall not be located below the Unit's center of gravity or in any condition which could result in an unstable lift without written approval per paragraph 6.1.5.1.

6.1.5.2 It must be possible to lift the Unit by crane using no more than 4 and no less than 2 ILAs.

6.1.5.3 The ILAs shall be located on the Unit so that the Unit can be lifted in a level fashion. The Unit's Base of Support must not form an angle greater than 5 degrees from horizontal when lifted. See figure 3.

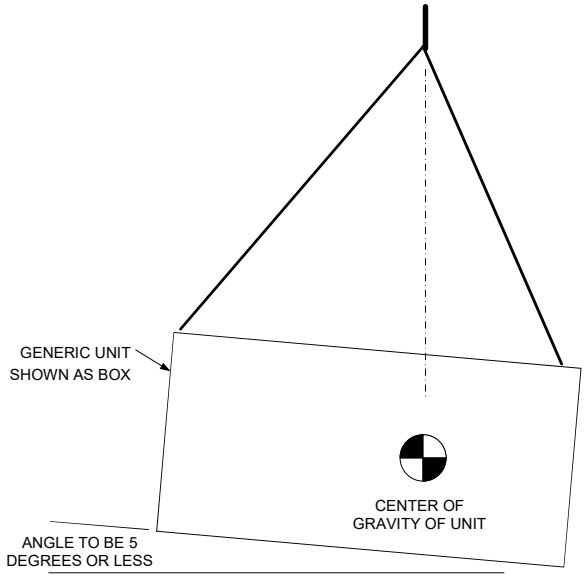

Figure 3: Maximum Allowable Tilt in Lift

6.1.5.4 The ILAs must be situated/located on the Unit so that the item can be lifted using standard rigging equipment such as shackles, swivel hoist rings and slings.

6.1.5.4.1 Lifting arrangements which require strongbacks, spreader beams, non-standard (metric) threads, eyebolts, or other unique lifting gear in order to be lifted by crane must be approved in writing per paragraph 6.1.3.1.

6.1.5.4.2 Locate the ILAs such that the path of the rigging gear is clear of obstructions (i.e., hand rails do not impede the sling when lifting).

6.1.5.5 ILAs must be designed to allow for the proper connection of standard rigging gear as provided by ASME B30.26. ILAs shall not be solely designed for direct connection into a hook without written approval per paragraph 6.1.3.1.

6.1.5.6 ILAs must be oriented so that the worst case forces that result when the Unit is lifted do not cause stresses that exceed the allowable stresses provided herein. Specifically, if padyes are used as ILAs they should be oriented on the Unit so that the resulting direction of pull exerted by the rigging equipment lies within 5 degrees (10 degrees included angle) of the plane formed by the padeye plate. If the designed or intended use of padeye requires the applied load to be directed out of plane with the padeye plate (greater than 5 degrees), the following conditions must be met: the padeye must be designed so that such loading (under worst case conditions) does not result in stresses which exceed the allowable stresses described herein (see ILA Design section), marking/documentation must be provided to indicate that out of plane loading is acceptable, and written approval must be received per paragraph 6.1.3.1.

6.1.6 <u>ILA DESIGN</u>

6.1.6.1 The Designer of the ILAs shall be a Qualified Engineer.

6.1.6.2 All calculations shall be reviewed by a Qualified Engineer other than the Designer.

6.1.6.3 Prior to fabrication, all calculations shall be provided by the designer/contractor and must be approved by PNS, with concurrence from PNS Lifting and Handling Department Technical Division (Code 710).

6.1.6.4 Design lifting attachments to accept standard rigging hardware or handling equipment (ASME B30.26 equipment). Attachment points on components that are part of a larger system (e.g., multiple components which form an enclosure) shall be sized such that one set of standard rigging equipment can be used to lift all components of the system.

6.1.6.5 The WLL of each ILA shall be sized based on the worst case loading that it may be required to resist, based on the location of a ILA relative to the Unit's center of

gravity and the other ILAs, on the maximum angle from vertical formed by the lifting slings, and on the ability for the connected rigging gear to equalize between structurally redundant connections (when 4 slings are used to lift the Unit). In arrangements where four (4) ILAs are used, each ILA must be designed so that either pair of diagonally opposed ILAs are capable of supporting the entire load of the Unit (with the force magnifying effects of sling angles being considered) without infringing on the safety factors stipulated herein. See figure 4.

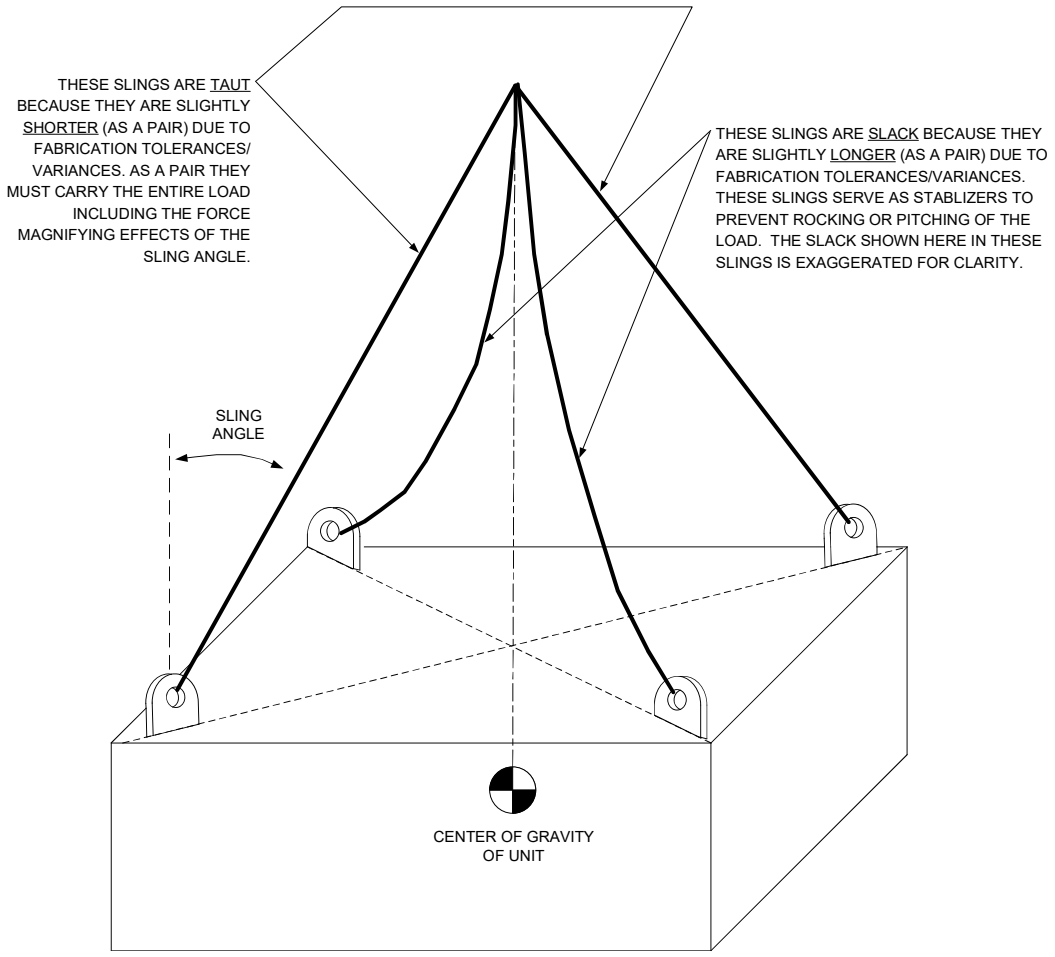

Figure 4: Worst Case Loading When 4 ILAs are Used

6.1.6.6 The WLL of each ILA shall be sized to provide margin between actual load to be lifted and the design load. See table 1 for minimum margin requirements. Additional margins should be considered for integral attachments subjected to situations with the potential for increased loading (e.g., binding or hang-ups due to seals of tight tolerances, additional weight in buildings/enclosures or fluid filled voids, etc.).

Table 1: Minimum Required Design Margins

Total Item Weight (lbs.)	Design Weight
Less than 1,000	200%
1,000 – 10,000	150%
10,001 – 100,000	125%[1]
Greater than 100,000	115%
NOTE: Percentage may be reduced to 115 percent IF the weight of the item is known (not estimated) AND the potential for binding or added weight does not exist.	

6.1.6.7 ILAs shall be designed using American Society of Mechanical Engineers (ASME) BTH-1. The allowable stresses for ILAs, including welded connections, shall meet the requirements for ASME BTH-1 for Category B lifting devices using the appropriate Service Class. Welded connections must also be designed in accordance with American Welding Society (AWS) Specification D1.1, as detailed below.

6.1.6.8 Any welds shall be designed per AWS Specification D1.1 with the following exceptions: Welds shall be designed with a safety factor of 5.0 with respect to the ultimate strength of the weld metal or base metal as applicable. A factor of 0.6 shall be applied when calculating allowable shear stress. For example, the allowable stress of a fillet weld shall be $(0.6)(F_u)/5.0$, since fillet welds are generally assumed to fail in shear, where F_u is the ultimate strength of the weld filler material or the base metal as applicable. The allowable stresses provided here apply only to the failure modes, which directly relate to the ILA and the connecting weld joint. These allowable stresses do not apply to any adjacent surrounding structure; however, such surrounding structure may be required to resist a one-time applied load equal to 210 percent of the WLL of the ILA in the cases where 200 percent load tests are required as provided herein.

6.1.6.9 Any ILAs (excluding threaded or through-holes installed directly into a structural element of the Unit) are to be connected to the Unit using a welded joint which meets the requirements of paragraph 6.1.4.7. Welded joints connecting ILAs to the Unit structure shall be designed using a continuous weld around the exterior of the joint (as a minimum) in order to prevent the entry of moisture into any interior un-bonded portion of the joint that may exist. Bolted joints that directly connect an ILA to the Unit are not permitted. This does not apply to bolted joints placed elsewhere in the structure of the Unit that do not serve as a structural connection directly between the ILA and the Unit.

6.1.6.10 Threaded holes used as ILAs may only be installed on Units which are primarily intended for in-door use. Where threaded holes are used as the ILA (e.g., for use with swivel hoist rings or eyebolts), the length of threaded holes must be at least 1.5 times the nominal thread diameter for steel, or 2.0 times the nominal thread diameter for aluminum.

6.1.6.11 Only standard imperial (non-metric) UNC - Class 2B threads may be used as threaded holes intended for use as ILAs.

6.1.6.12 Threaded holes intended for use as an ILA must be located to allow for 360-degree rotation and 180-degree pivot of a standard swivel hoist ring bail.

6.1.6.13 Threaded holes intended for use as an ILA must be located on the structural element so that the seating surface of a mounted swivel hoist ring does not overhang the edge of the structural element and the mating face of the structural element is flat to match that of a standard swivel hoist ring.

6.1.6.14 All surfaces of an ILA which could be subjected to moisture, corrosion, or wear due to movement must be accessible for inspection without disassembly.

6.1.7 LOAD TEST

6.1.7.1 Any ILA attached via a weldment with a capacity greater than 6000 lbs. must receive a one-time 200 percent load test, which shall be administered by the contractor prior to delivery of the Unit.

6.1.7.2 The applied test load shall be 200 percent of the design capacity (WLL) with a tolerance of +5%/-0% of the test load. In other words, the applied test load shall be a minimum of 200 percent and a maximum of 210 percent of the design capacity (WLL) of the ILA. The test load shall be maintained for a period no less than 2 minutes.

6.1.7.3 The test load can be applied to each ILA individually or to multiple ILAs at once provided it can be shown through basic mechanics that each tested ILA received the proper test load value. Applied test load should mimic the as-used/as designed configuration to the maximum extent practicable, with alternate loading configurations approved by the designer.

6.1.7.4 Written documentation shall be provided by the contractor, which documents the completion of this test for each ILA listing the ILAs tested, actual applied load, test date, 2-minute test duration and signature of person performing the test. Written certification documentation shall be provided to PNS technical code at least 7 days prior to delivery of the unit being purchased.