

INSTALLATION PROCEDURE



Simsite[®] Products
(Navy Grade)



Advanced Composites
*Impellers, Casing Rings,
Shaft Sleeves and Bearings*



TABLE OF CONTENTS

Paragraph	Page
1. Introduction.....	3
2. Installation of Simsite Casing Rings into End Suction Pumps.....	3
3. Installation of Set Screws with a Simsite Casing Ring	4
4. Simsite Impeller Wear Rings	4
5. Installation of Simsite Casing Rings in Split Case Pumps.....	5
6. Machining of Simsite Material.....	5
7. Installation of Simsite Impellers.....	5
8. Installation of Simsite Impellers with Tapered Bores.....	6
9. Installation of Simsite Bearings	7
10. Installation of Simsite Sleeves.....	8
11. Determination of Clearances Between Wearing Surface	9
12. Allowable TIR of Simsite Wear	9
13. Assembly and Testing Considerations	9
14. Balancing the Rotating Assembly.....	10
15. Contacting the Factory for Assistance.....	11

LIST OF TABLES

Table	Page
1 Interference Fits	12
2 Factory Set Ring Clearances and Standards	13
3 Bearing Set Clearances and Standards	14

INSTALLATION PROCEDURES FOR SIMSITE® PRODUCTS

1. INTRODUCTION

1.1 These instructions provide the user with the basic installation procedures for Simsite products, supplementing existing metallic pump technical manuals and or Technical Repair Standards. If a conflict develops between the existing procedures and this instruction, this instruction takes precedence. These instructions, along with basic knowledge of pump assembly and maintenance practices, will assure optimum efficiency and life of the Simsite part. The installation philosophy for pumps containing Simsite components differs slightly from that of pumps with metal internals. Although Simsite materials have a high strength-to-weight ratio and are superior to metallic in corrosion resistance, they are softer and lighter than metals and must therefore be handled and installed with care to avoid damage. When installing Simsite parts, never strike the composite component with a hard tool or object. Use only a soft wood, plastic or rubber hammer if you need to tap them into place. Never use a puller on Simsite (unless tapped puller holes are provided) or put a direct flame on the composite. If this installation procedure, along with the specific equipment technical manuals and/or Technical Repair Standards are not followed, all warranties and guarantees will be void.

2. INSTALLATION OF SIMSITE CASING RINGS INTO PUMP CASING WHEN A PRESS FIT IS REQUIRED (END SUCTION OR OVERHUNG TYPE PUMPS)

2.1 Prior to the installation of Simsite rings, the pump casing ring bore areas in the pump casing should be cleaned and all burrs removed. The casing ring bore should be indicated to make certain that it is round, concentric with the impeller locating features. If the casing bore is not running true, it should be machined before the Simsite casing ring is installed.

2.2 When pressing a Simsite casing wear ring into a pump casing, an interference fit must be added to the outer diameter of the ring as would be done with a metal ring. Warren recommends an interference fit of .001 in. per diametrical in. with a minimum of .003 in. and a maximum of .010 in. for diameters up to 12.000 in. (To set the interference for those rings with a diameter above 12.000 in., please consult the factory.) For example, an 8.000 in. diameter casing wear ring would be machined to 8.008 in. for an interference fit of .008 in. into the casing. See Table 1 for the interference fits of Simsite components.

2.3 Simsite rings can be chilled or frozen to facilitate pressing the rings into the casing. Pressed Simsite casing rings must be secured with a two-part epoxy (Devcon Putty "A" ; Fixmaster or equivalent) and with 3 - 4 set screws.

3. INSTALLATION OF SET SCREWS WITH A SIMSITE CASING RING

3.1 When installing set screws into a metal casing to secure the Simsite casing ring, the holes for the set screw should be drilled so that 75-80 percent of the screw will be in the casing and only 20-25 percent in the Simsite composite ring. The size of the set screw being installed should be the same size as the original set screws or the same size that would be used if a metallic casing ring were being installed. Care must be taken to ensure that the drill or tap does not walk towards the softer composite material when drilling and tapping for the set screws. If necessary, make a fixture to prevent this problem. When tapping the holes for the set screws, standard tapping procedures should be followed.

WARNING

Do not force the tap.

3.2. After set screws are installed, the casing ring inner diameter must be checked for possible distortion. If the distortion is greater than .002 in. then a final machining cut will be required to maintain the necessary operating clearance.

4. SIMSITE IMPELLER WEAR RINGS

4.1 **Installation of Simsite impeller wear rings is not necessary.** When a new Simsite impeller is purchased, Simsite wear rings come standard (integral) with the impeller. A common misconception is that the impeller needs separate wear rings. Since Simsite rings do not seize and gall like metallic rings, the impeller wear ring surface should be trued-up in a lathe when necessary and new undersize Simsite casing rings should be purchased.

WARNING

Do not press metallic wear rings onto a Simsite® impeller. Metallic rings have a different rate of thermal expansion and could loosen with use, and the moisture absorption of the composite material can lead to loosening.

5. INSTALLATION OF SIMSITE CASING RINGS INTO PUMP CASING WHEN A PRESS FIT IS NOT REQUIRED (SPLIT CASE OR BETWEEN BEARINGS TYPE PUMPS)

5.2 When installing casing rings that are not press fitted into their casings, it is important that there is enough clearance at the outer diameter to assure that the casing rings are not pinched upon bolt-down of the pump casing. It is recommended that a .002 to .005 In. clearance is maintained between the casing ring outer diameter and the pump casing.



5.3 To determine if the ring is pinched, the ring must be blued (or chalked), installed in the pump, and then removed for inspection. Upon inspection of the ring, pinching marks should not be evident on the blued or chalked surfaces of the casing ring. If pinching exists, then the ring may require machining. However, ring machining is not recommended if the pinching is caused by casing distortion, or if there is damage to the casing ring landing surface within the casing. In this case, the casing must be corrected by machining as outlined in paragraph 5.1.

6. MACHINING OF SIMSITE MATERIAL

6.1 In cases where undersize casing rings are provided, it will be necessary to machine the ring to achieve the proper clearance between the impeller and case ring. See Section 11 for the correct clearances to be used with Simsite components.

6.2 Simsite is easily machined using standard carbide insert tools and is similar to machining cast iron. Turning speeds should be between 200 to 400 RPM.

6.3 When machining Simsite, always make sure there is proper ventilation. The use of a respirator (3M Model 8710 or equal) is recommended when machining Simsite Grade 302 and is required when machining Simsite Grade 375 due to the glass content.

7. INSTALLATION OF SIMSITE IMPELLERS

7.1 To install a Simsite impeller into a pump, it is necessary to confirm that the shaft is true (i.e. shaft run-out less than .002 in.), and that the shaft diameter where the impeller will seat is in good condition. The keyway must be checked to assure that it is clean and that the key fits snugly side-to-side in the keyway. There should be approximately a 0.010" clearance on top of the key when it is installed into the shaft and impeller. The impeller should not be pressed onto the shaft if a keyed shaft installation is employed. The bore of a Simsite impeller is manufactured .002 in. (dry) over the shaft diameter. Simsite will swell slightly in water, allowing the fit of the impeller to have an approximate clearance of .0005 to



.001 in., which is necessary for a keyed shaft arrangement. A soft mallet can be used to gently position the impeller onto the shaft.

WARNING

Never force a Simsite® impeller onto the shaft.

If humid conditions or temperature cause the fit to be tight, the shaft may be lubricated with grease (DOD-G-24508, CID-A-A-50433 or equivalent). Another installation technique for a tight fit is to heat the impeller in an oven to expand the tight bore. **Never exceed 250 degrees F.**

WARNING

Do not use an open flame or exceed 250 degrees F.

7.2 It is not possible to give detailed torque specifications in a general instruction such as this, since a large variety of different sized impeller nuts are in use. When torquing the impeller nut against a Simsite impeller it must be understood that the Simsite composite stiffness is much less than that of the typical metallic alloys used for pump impellers. Excessive torquing of the impeller nut can lead to large distortions of the impeller and must be avoided. If the existing technical manual calls for an impeller nut torque, Warren recommends using 1/3 the metallic value (minimum of 20 ft-lb). Experience and "feel" are important considerations, especially if no torque specifications are available. It is also worth noting that when immersed in water the Simsite impeller will swell, further pre-loading the impeller nut.

WARNING

Do not over-torque impeller nut when installing a Simsite® impeller.

8. INSTALLATION OF SIMSITE IMPELLERS WITH TAPERED BORES

8.1 For the design of impellers with a tapered bore, the standard taper must be specified along with the length of the bore and the end diameters. The integrity of the tapered shaft at the taper must be excellent, otherwise the shaft must be replaced. If a collet is used, it should be replaced each time a new Simsite impeller is installed. If the Simsite impeller has a metal hub insert, then the impeller nut can be installed on the shaft with a torque limit of 80 ft-lb.

WARNING

Do not exceed 80 ft-lb for tapers with metal inserts.

However, if the impeller is of all -Simsite construction, then the impeller nut should be installed with the minimum of torque that is necessary to fit the impeller snugly onto the tapered shaft.

WARNING

Do not exceed 20 ft-lb for tapers without a metal insert.

9. INSTALLATION OF SIMSITE SLEEVE BEARINGS

9.1 Simsite bearings using a press fit are installed into the bearing housings using interference fits similar to casing wear rings. Prior to the installation of the Simsite bearings, the bearing bore areas should be cleaned and all burrs removed. The casing bores should be indicated to make certain that they are round and concentric with the impeller locating features. If the bearing bore is not running true, it should be machined before the Simsite bearing is installed. The interference is recommended to be .001 in. per diametrical in., with a minimum of .003 in. and a maximum of .010 in. The bearings can be chilled or frozen to facilitate pressing them into the pump casing or bearing housings. A soft mallet can be used to gently press the bearings into their bores. Simsite bearings must be secured in the housings with a two-part epoxy (Devcon Putty "A", Fixmaster or equivalent) and two-to-four set screws.



9.2 When Simsite bearings are not press-fit into the pump casing or bearing housings, they are designed with an anti-rotation ring or one or more anti-rotation pins. Prior to the installation of the Simsite bearings, the bearing bore areas should be cleaned and all burrs removed. The casing bores should be indicated to make certain that they are round and concentric with the impeller locating features. If the bearing bore is not running true, it should be machined before the Simsite bearing is installed. It is important that there is enough clearance at the outer diameter of the bearing to assure that the bearings are not pinched upon bolt-down of the pump casing or bearing housing cover. It is recommended that a .002 to .005 in. clearance is maintained between the Simsite bearing outer diameter and the bearing mounting surface. To determine if the Simsite bearing is pinched, the bearing must be blued (or chalked), installed in the pump, and then removed for inspection. Upon inspection of the bearing, pinching marks should not be evident on the blued or chalked surfaces of the bearing. If pinching does occur, then the Simsite bearing may require machining. Machining of the Simsite bearing is not recommended if the metallic pump casing is distorted, or if there is damage to the bearing housing surfaces. The bearing mounting areas must be repaired or machined instead. After machining, the bearing mounting areas must be cleaned and deburred.

9.3 The clearance between the Simsite bearing bore and the shaft or sleeve diameter should follow the guidelines of Table 3 and should never be less than .010 in.

10. INSTALLATION OF SIMSITE SLEEVES

10.1 Simsite sleeves are mounted on shafts with a clearance of between .001 and .004 in. This clearance prevents the sleeve from twisting and buckling, yet allows easy mounting. A locking device such as a key and/or set screws is used to prevent the sleeve from rotating. If humid conditions or temperature cause the fit to be tight, the shaft may be lubricated with grease (DOD-G-24508, CID-A-A-50433 or equivalent). Do not use oil. Another installation technique for a tight fit is to heat the sleeve in an oven to expand the tight bore.

Do not use an open flame or exceed 250 degrees F.

WARNING

Never force a Simsite® sleeve onto the shaft.

WARNING

Do not use oil.

WARNING

Do not use an open flame or exceed 250 degrees F.

CAUTION

**GRADE 302 SIMSITE® SHAFT SLEEVES
ARE NOT TO BE USED**

Simsite shaft sleeves used in conjunction with packing are manufactured from Simsite grade 375. A graphite-based packing (John Crane CI 065 or Style 1625G, Durametallc Style TGF or Style DDG, Industrial Packing Style 102, Garlock Style G-200 or similar) should be used with Simsite sleeves.

11. DETERMINATION OF CLEARANCES BETWEEN WEARING SURFACES

11.1 The diametrical clearances between Simsite casing rings and Simsite impellers are provided in Table 2. Table 3 shows the diametrical clearances for Simsite bearings. It should be noted that these clearances are determined for dry Simsite parts mating with dry Simsite parts. If the Simsite part is used in conjunction with a metal mating part, these clearances can be decreased by 25 percent. (Example: a 12.000 in. diameter Simsite ring mating with a metal impeller would require a diametrical clearance of .030 in.) If a Simsite casing ring requires a press fit into a casing, the amount of interference fit is added to the dry factory set clearance.

11.2 If the Simsite components have been in service (immersed in a fluid), they must be allowed to dry for a 24-hour period prior to measurement, since Simsite composites swell slightly in water.

12. ALLOWABLE TIR OF SIMSITE IMPELLER WEAR RING AREA

12.1 If Simsite impellers are used with Simsite casing rings, the allowable total indicated runout (TIR) of the wear ring area should not exceed .005 in. If Simsite rings are used with metallic impellers, the total indicated runout (TIR) should not exceed .002 in.

13. ASSEMBLY AND TEST CONSIDERATIONS

13.1 The alignment of the coupling and the shaft must be checked both cold and warm after assembly. Proper alignment is critical to pump operation and longevity. For ship board installation, all major piping must be loosened to make sure there is no pipe strain. If the piping moves after the bolts are removed, the piping must be repositioned to eliminate pipe strain, which can cause a pump to fail if not corrected.

13.2 After the rotating element with Simsite components is fit into the pump casing and the casing cover has been secured, the rotating element must turn by hand before the pump driver can be started. If for some reason the shaft does not turn by hand, then the pump must be disassembled to determine the problem. **In order to maximize the extended pump life that Simsite components offer, Warren recommends replacing all rolling element bearings while rebuilding the rotating assembly.**

13.3 After flooding the pump and prior to start-up, make a final check to ensure that the rotating element still turns by hand. Refer to the applicable equipment technical manual and/or Technical Repair Standards for specific instructions.

13.4 When performing operational testing it is recommended that the pump with Simsite internals be filled with fluid for 48 hours in order to achieve the correct running clearances and thus obtain accurate test results.

14. BALANCING THE ROTATING ASSEMBLY

CAUTION

DYNAMIC BALANCE BY GRINDING OFF MATERIAL MUST NEVER BE DONE ON SIMSITE® COMPONENTS.

14.1 Simsite impellers and pump components are precision machined to assure dynamic balance, hydraulic balance and optimal performance. The dynamic balancing of Simsite products by weight adjustment (i.e. grinding off material or adding balancing weights such as set screws) is usually not necessary and may be harmful to the integrity of the components if done improperly.

14.2 If a check of the impeller balance is desired, the impellers must be checked independently from the complete rotating element. Because of the light weight of the Simsite (approximately 1/6 of a metallic impeller) the standard Navy formulas for maximum allowable unbalance will give unbalance levels that are very difficult if not impossible to attain in practice. Warren supplies impellers that meet or exceed the requirements as outlined in paragraph 4.2.2.9 of NAVSEA Dwg 803-7226047: "Composite impellers shall not exceed the maximum residual imbalance as calculated by ANSI 52.19 Grade G6.3 when using the mass of the metallic impeller it is replacing." If dynamic balancing of a complete rotating assembly is required, then the necessary weight adjustment should be performed on the metal components of the assembly, if at all possible. If weight adjustment to the Simsite impeller is necessary, it should always be accomplished by adding weight, not by removing weight by grinding as is usually done with metallic impellers. To add weight to the impeller use a monel set screw (8-32, 10-32, or 1/4-20). The impeller should be drilled and tapped to accept the set screws either in the side of the wear ring area or in the shroud of the impeller in the middle of one or more of the vanes. The set screws should be screwed in with Loctite (or equivalent) and covered with a molecular compound (Belzona, Devcon, Sims, etc.) to cover the screw.

14.3 When drilling and tapping a Simsite impeller for balancing purposes, the following steps should be followed:

- 1) Secure impeller with clamps, studs, nuts, etc. on drill press table. Do not put excessive stress on the composite impeller.
- 2) Secure center drill in chuck and center drill impeller at desired point. Do not move impeller between operations.

- 3) Install proper size drill bit for the tap size in chuck and drill to the proper depth. Drill deep enough to ensure that the end of the installed set screw will be slightly below the surface of the impeller. Clean chips from hole.
- 4) Chuck tap in a tapping machine or tap by hand, rotating the tap slowly. Tap hole, clearing the chips periodically from the hole. Do not use excessive force when tapping!
- 5) Use a bottom tap to finish the threads. Follow the same procedures as in step 4.
- 6) Install the monel set screws using Loctite and Primer 'T' (or equivalent). Do not overtighten the screws!
- 7) If the set screws need to be cut, then cut and grind the edges of the screws before screwing them into the composite.
- 8) The set screws must be countersunk into the composite and covered with a molecular compound (Belzona, Devcon, Sims, etc.).

15. CONTACTING THE FACTORY FOR ASSISTANCE

15.1 If help is needed with the installation of a Simsite product. you can contact the factory at (413)436-7711. or fax (413)436-5605. Correspondence may be addressed to:

**Warren Pumps Inc.
82 Bridges Avenue
P. O. Box 969
Warren, MA 01083-0969, USA
E-mail: warrensales@colfaxcorp.com**

TABLE 1

INTERFERENCE FITS FOR OVERHUNG PUMP CASE RINGS AND BEARINGS	
Diameter of Press Fit Component (inches)	Recommended Diametrical Interference (inches)
1	.003
2	.003
3	.003
4	.004
5	.005
6	.006
7	.007
8	.008
9	.009
10	.010
11	.010
12	.010
13 to 16	.014
17 to 24	.016

TABLE 2

FACTORY SET CLEARANCES AND STANDARDS SIMSITE® CASING WEAR RING TO SIMSITE IMPELLER WEAR RING DRY CLEARANCE		
0. D. Impeller Wear Ring (inches)	Diametrical Clearance (DRY) and Tolerance (inches)	Recommended Maximum Clearance (DRY) before Replacement (inches)
2	.024 +/- .004	.032
3	.026 +/- .004	.034
4	.028 +/- .004	.036
5	.030 +/- .005	.039
6	.032 +/- .005	.042
7	.034 +/- .005	.044
8	.036 +/- .005	.046
9	.037 +/- .005	.047
10	.038 +/- .005	.048
11	.039 +/- .006	.051
12	.040 +/- .006	.052
13	.041 +/- .006	.053
14	.042 +/- .006	.054
15	.042 +/- .006	.054

NOTES:

1. If a Simsite ring is used in conjunction with a metal impeller, then the diametrical clearance is reduced to 75 percent of the value from the above chart.
2. All installation clearances are based on the components being dry. When reusing a wear ring, allow the ring to dry for 24 hours before taking dry clearance measurements.
3. When machining Simsite rings, the minimum wall thickness is .187 in.
4. When installing set screws to secure Simsite wear rings, the casing ring inner diameter should be checked for possible distortion after the set screws are installed. If the distortion is greater than .002 in. then a final machining cut will be required to maintain the necessary operating clearance.
5. The recommended maximum clearance before replacement should be used as a guide. Pump performance should be the final element in determining whether the parts are to be replaced.

TABLE 3

SIMSITE® BEARING CLEARANCES WHEN RUNNING SIMSITE SHAFT OR SLEEVE ON SIMSITE BEARINGS	
Shaft or Sleeve Diameter (inches)	Recommended Dry Diametrical Clearance and Tolerance (inches)
1	.010 +/- .002
2	.014 +/- .002
3	.016 +/- .002
4	.018 +/- .002
5	.020 +/- .002
6	.022 +/- .003
7	.024 +/- .003
8	.026 +/- .003
9	.028 +/- .003
10	.030 +/- .003

NOTES:

1. If a Simsite bearing is used in conjunction with a metal sleeve or shaft mating surface, then the diametrical clearance is reduced to 75 percent of the value from the above chart.
2. All installation clearances are based on the components being dry. When reusing a bearing, allow it to dry for 24 hours before taking dry clearance measurements.

Warren Pumps Inc.
P. O. Box 969
Warren, MA
01083-0969

tel 413.436.7711
fax 413.436.5605



This instruction for installation of Simsite Composite Components is approved per Department of the Navy, Naval Surface Warfare Center, Naval Ship Systems Engineering Station letter 9503, Ser 9232/046, dated 20 May 1997.