



reaction technology

MAINTENANCE MANUAL FOR DE DIETRICH GLASS-LINED STEEL EQUIPMENT

**A REFERENCE GUIDE
FOR THE HANDLING,
START-UP, OPERATION
AND MAINTENANCE OF
DE DIETRICH GLASS-
LINED STEEL PROCESS
EQUIPMENT**

- **GENERAL
INFORMATION**
- **GASKETING**
- **HOW TO
CONTACT US**
- **INSTALLATION &
START-UP**
- **JACKET
CLEANING**
- **PREVENTIVE
MAINTENANCE**
- **RECOMMENDED
BOLT TORQUES**
- **RECOMMENDED
SPARE PARTS**
- **SERVICE
HOOK-UPS**
- **WARRANTY**



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DEFINITION OF POTENTIAL HAZARDS

The information that follows in this bulletin is intended to be used as a guide in the handling, operation and maintenance of the equipment supplied. De Dietrich Process Systems, Inc. **Expressly Disclaims Any Understandings, Agreements, Representations or Warranties Implied, Including Any Regarding Warranties of Merchantability or Fitness for a Particular Purpose in Connection with the Information Contained in this Bulletin.**

De Dietrich Process Systems, Inc. does not supply nor imply that any information has been supplied concerning project engineering, plant design or process design pertaining to the equipment supplied. The information supplied is general in nature and does not specifically apply to a particular process or application.

All of our equipment is designed and fabricated in accordance with the applicable codes and excellent manufacturing techniques and it is the responsibility of the user to properly install, operate and maintain the equipment within the design parameters stated on the equipment nameplate. Warning and safety devices are to be provided by the user.

The following definitions are provided to explain the degree of hazard that De Dietrich Process Systems recognizes to be associated with the installation and operation of De Dietrich products. These terms are used throughout the De Dietrich Instruction Bulletins to enable the user to identify the potential degree of hazard.

DANGER: IDENTIFIES HAZARDS WHICH COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH

WARNING: IDENTIFIES HAZARDS WHICH COULD RESULT IN PERSONAL INJURY

CAUTION: IDENTIFIES HAZARDS WHICH COULD RESULT IN DAMAGE TO EQUIPMENT OR PROPERTY

NOTE: ALERTS USERS TO PERTINENT FACTS AND CONDITIONS

De Dietrich Process Systems, Inc. WARRANTY CONDITIONS

Our warranty is subject to certain conditions, which the Buyer must adhere to. These conditions are required to maintain the warranty:

1. Use of gaskets, clamps or bolts approved by De Dietrich.
2. Use of the proper number of clamps.
3. Correct usage of the vessel as approved by De Dietrich.
4. Storage of the equipment as recommended by De Dietrich.
5. Proper rigging, handling and installation procedures per De Dietrich recommendations.
6. Repair of the damaged equipment with notification and permission from De Dietrich.
7. Repair of the equipment in accordance with the applicable codes.
8. Operation of the equipment within the limits stated on the nameplate regarding temperature and pressure.
9. Proper cleaning of the exterior of the vessel when subjected to acid spills.
10. Proper cleaning of the jacket per De Dietrich recommendations.
11. Use of corrosive chemicals approved by De Dietrich.
CAUTION: SEE DE DIETRICH BULLETIN 3009 GLASS FOR CORROSION GUIDELINES.
12. Proper operation, lubrication and maintenance of any mixing equipment supplied with the equipment.
13. Use of the correct mechanical seal and lubricant as approved by De Dietrich.
14. Use of the spark tester recommended by De Dietrich and not exceeding 6000 volts during testing.
15. Use of authorized personnel for inspection.

NOTE: Items such as gaskets and mechanical seals are not covered by the warranty.



SECTION I: GENERAL INFORMATION

1.0 Handling and Inspection

1.1 Before shipment, all De Dietrich vessels are carefully inspected, tested and securely mounted on strong wooden skids. Special care must be used in handling the equipment during removal and installation. De Dietrich Technical Service Specialists are available to supervise the installation of the equipment for those who are not familiar with this procedure. Contact our office in Union, New Jersey. See inspection procedure in Section III of this manual.

1.2 Equipment Identification

The nameplate of all De Dietrich equipment contains the following information (See Figure 1)

1. Manufacturers Identification Number (Serial Number)
2. National Board Registration Number
3. Vessel Design Pressure
4. Vessel Design Temperature Range
5. Vessel Capacity
6. Year Vessel Fabricated
7. Type of Glass Lining

Figure 1

The vessel nameplate should never be removed; however, all the data on the nameplate should be copied and stored with all other documents pertaining to the vessel. If the nameplate is lost or destroyed, contact De Dietrich for method of replacement.



1.3 Repair Plugs in New Vessels

Vessels may occasionally be supplied with one or more factory installed repair plugs. The plugs are normally fabricated out of tantalum. If this material is not satisfactory because of process conditions or the possibility of galvanic corrosion due to two dissimilar metals in the vessel, please advise De Dietrich before shipment so that the proper material of construction can be supplied.

1.4 Accepting The Vessel

1.4.1 Upon receipt of the vessel a very careful examination should be conducted while the unit is on the truck. Inspection should include the support system for shifting during transit or for any signs of impact to the outside of the vessel. If there are any signs of external damage, make a note of the damage on the Bill of Lading and advise De Dietrich as well as the carrier.

1.4.2 Open the vessel manway and make a complete visual inspection of the glass lining of the vessel and all accessories. See Section III, paragraph 2.2 of this manual for inspection procedures.

CAUTION: WHEN ENTERING THE VESSEL, BE SURE TO REMOVE ALL METAL OBJECTS FROM YOUR CLOTHING AND WEAR CLEAN RUBBER TOTES OR SNEAKERS. USE PROTECTIVE PADDING IN THE VESSEL AS REQUIRED.

1.4.3 If any damage is found during the inspection, immediately bring it to the attention of the carrier's representative and note the damage in writing to the carrier and De Dietrich. The carrier's representative should also sign the document indicating damage.

1.5 Installation and Start-Up

Detailed instructions for installation and start up of your vessel are given in Section II of this bulletin. Be sure to follow them carefully or contact De Dietrich for the support of qualified personnel to supervise the installation and start-up.

1.6 Operation Limitations

The operating limits of a glass-lined steel vessel are based upon the following:

1. Mechanical – Pressure/vacuum, nozzle loading, torquing, abrasion
2. Thermal – Operation temperatures, thermal shock, thermal stress
3. Electrical – Spark testing voltage, static discharge
4. Chemical – Type, concentration
5. Specific gravity/viscosity of contents

The design limits of a vessel are based upon the steel only in accordance with the applicable ASME code. The design pressure and temperature are stamped on the nameplate of the vessel.

NOTE: Vessels fabricated for lethal service require special attention per ASME Code Section VIII, Division I and ANSI B31.3 (Chemical Plant and Petroleum Piping Code)

DANGER: NEVER OPERATE WITH PRESSURES OR TEMPERATURES EXCEEDING THOSE STAMPED ON THE NAMEPLATE.



CAUTION: VARIOUS INSTALLED ACCESSORIES SUCH AS MECHANICAL SEALS, VALVES, SIGHT GLASSES, RUPTURE DISC, ETC. MUST BE CONSIDERED WHEN DETERMINING THE MAXIMUM PRESSURE AND TEMPERATURE FOR OPERATION. THESE ITEMS MAY LIMIT OPERATIONS BELOW THAT WHICH IS STATED FOR THE VESSEL ITSELF.

The standard operational temperature range for all standard De Dietrich reactors is -20°F (-28.9°C) to 500°F (260°C). One major cause for vessel failure is thermal shock to the glass lining. Exceeding the recommended "safe temperature differential" will cause thermal shock. The chart shown in Figure 2 should be used as a guide for determining the safe differentials for enamel 3009 lining. For larger vessels, consult De Dietrich for guidelines. In addition, more information concerning our glass lining can be found in **Bulletin 3009 Glass**.

In general, the higher the operation temperature, the lower the safe temperature differential.

NOTE: Thermal stress caused by improper piping connections may be a reason for failure occurring below the safe temperature differential.

The glass lining will withstand a wide variety of chemical reactants. When in doubt consult our Bulletin 3009 Glass or De Dietrich to confirm the use of glass-lined steel for your application. In addition, all accessories used must be compatible with the process. Check the chemical resistance of all components and proceed accordingly.

Gaskets – All De Dietrich Type AFII gaskets will withstand most service conditions as 3009 lining.

Mechanical Seals – De Dietrich supplied seals will meet most conditions of chemical service. For strong oxidizing medium, the rotating carbon faces can be replaced with applicable substitutes such as silicon carbide or tungsten carbide.

Stuffing Box Packing – Packing is used for holder-mounted baffles and on the stems of bottom flush valves. Our standard supply is braided Teflon-impregnated graphite, suitable for most chemical service. Virgin PTFE packing is also available upon request.

Packing Support Ring – Normally supplied as PFA lined steel.

Drives - Refer to either Bulletin 788-3 (Series 60) or 980-1 (PTE Philadelphia Mixers).

1.7 Pressure – Temperature Ratings of Accessories

1. Pipe, Valves and Fittings
2. Convection Type Lubricator - 400 PSI @ 500°F (260°C)
3. Sensors
 - pH 150 PSI @ 284°F (140°C)
 - Temperature 300 PSI @ -20°F (-28.9°C) to 500°F (260°C)
 - GlasGuard® 300 PSI @ -20°F (-28.9°C) to 500°F (260°C)

See page 5 for 3009 Glass ΔT Chart (Figure 2)



MAXIMUM ALLOWABLE THERMAL SHOCK – 3009 GLASS

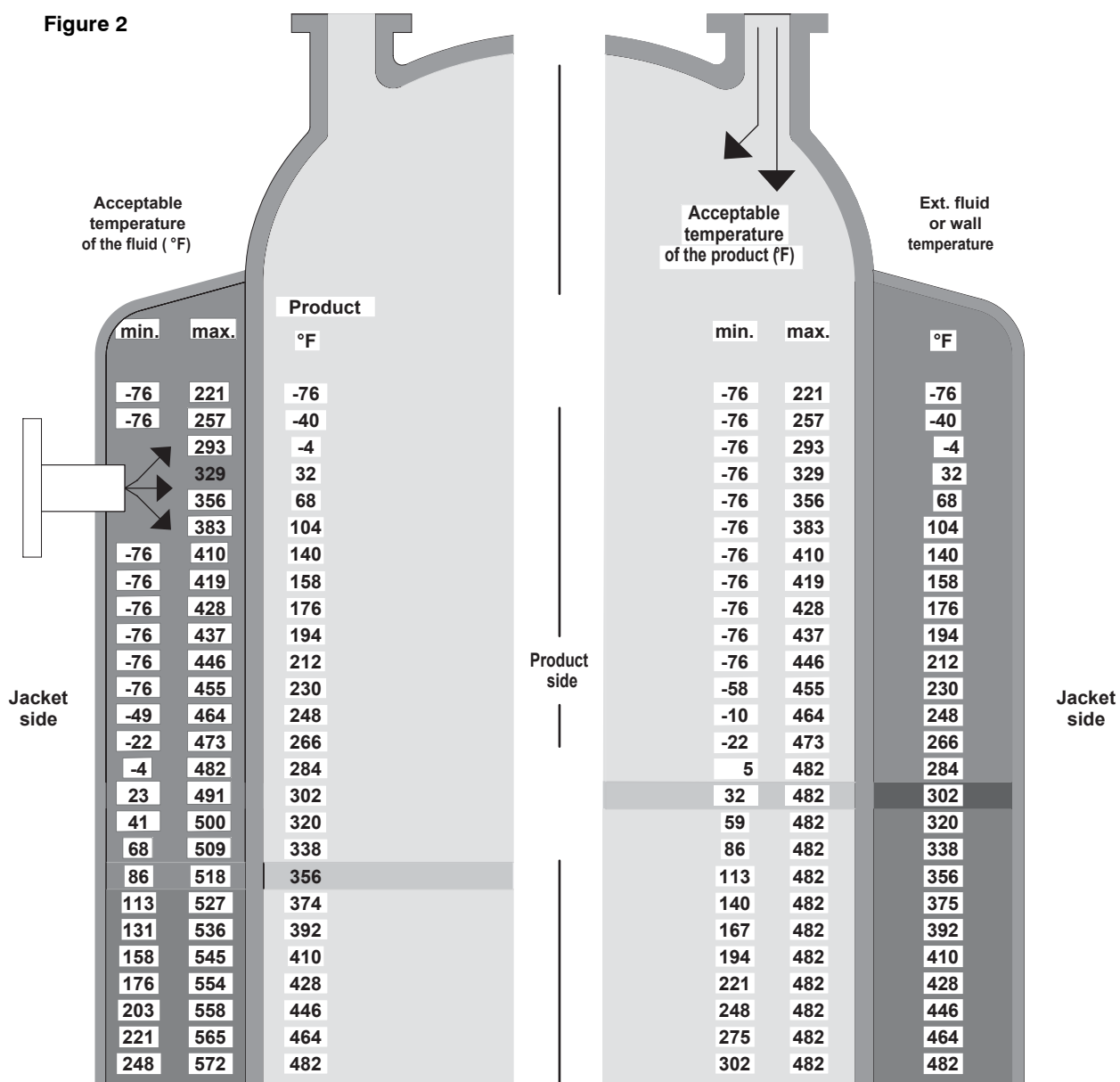
Example 1

Charging of the reactor when the glass-lined wall or fluid in the jacket is at 302°F. Materials between 32°F and 482°F may be safely charged into the vessel.

Example 2

Introduction of a heating or cooling fluid into the jacket. If the glass lined wall (and the batch) is at 356°F, the fluid introduction should be between 86°F and 518°F.

Figure 2





SECTION II: INSTALLATION AND START-UP

1.0 Responsibility

- 1.1 Before shipment, every De Dietrich vessel is carefully prepared for safe transit. It is inspected and tested, and nozzle protectors are provided. Internal cribbing/bracing is installed to secure the agitator, baffle(s) and dip pipe(s), if applicable. All vessels are securely mounted on strong wooden skids or braced inside wooden crates.

Acceptance of the equipment by the carrier is an acknowledgement that the shipment was received by them in good condition and properly packed. The carrier assumes the responsibility for safely handling the equipment in transit.

When glass-lined equipment arrives at your plant it should be inspected immediately, **before** unloading, to be sure no obvious damage to the glass lining has occurred. In addition to careful external inspection, the manway cover should be opened and an internal observation made. If glass particles or any other damage is apparent, insist that the carrier sign a notation on your copy of the freight bill defining the loss or damage. Immediately enter a claim with the carrier's office, and notify De Dietrich. (Do not return damaged equipment to De Dietrich without first obtaining a Return Material Number).

NOTE: After you are certain that there is no obvious damage, you or your contractor are now responsible for safe unloading and subsequent handling. Because careful handling is essential, many customers prefer to employ an experienced rigging contractor for installation of glass-lined equipment. The contractor then assumes the responsibility for safe installation. Whether a contractor is employed or your own personnel installs the glass-lined equipment, certain logical precautions should be carefully observed during unloading, rigging, general handling and installation. The following rigging recommendations are offered as a guide only and are not to be construed as an assumption of liability by De Dietrich.

2.0 Handling Precautions

- 2.1 Although the use of two cranes is generally recommended, the main crane should always be adequate to handle the entire weight of the vessel. Carefully inspect your crane or other lifting devices before beginning the lift to insure they are adequate for the load and in good condition. Note that the larger the angle between the legs, the greater the reduction in capacity (see Figure 3).
- 2.2 Always use slings, hooks and shackles of adequate capacity. Wire rope slings are preferred but polyester or nylon slings with ample safety factor may also be used. Carefully inspect all slings prior to use for wear and damage (refer to manufacturers' guidelines and recommendations).

CAUTION: CHAINS ARE ACCEPTABLE FOR STRAIGHT LIFTING BUT MUST NEVER BE ALLOWED TO CONTACT STEEL SURFACES, WHICH ARE GLASS-LINED ON THE OPPOSITE SIDE (E.G. TOP HEADS ON ALL VESSELS, BOTTOM HEADS OF TANKS). THE UNEVEN PRESSURE OF THE LINKS CAN CAUSE LOCALIZED STRESS LEADING TO GLASS FRACTURING ON THE INSIDE OF THE VESSEL.

- 2.3 Keep cables, slings and hooks away from nozzles and manways. Always insure such openings are properly protected with rubber caps and/or wooden or homasote boards. **Never** use nozzles, cover openings, drives, pipe legs or any other bolted attachments for rigging and supporting.



- 2.4 Never bump the vessel with cables, shackles, hooks, clamps, etc.; it can damage the internal glass lining.
- 2.5 Always maintain a smooth, steady lift. Try to avoid any jerking motion when lifting or lowering the vessel. Excessive strain on the lifting lugs may cause glass fracturing.
- 2.6 A glass-lined vessel must never be bumped into walls or other fixed objects. Be sure to provide adequate ground crew to direct crane operation and vessel handling during installation.
- 2.7 Never support a vessel on the ground or uneven flooring – even temporarily. Use the shipping cradle/skid for support until the vessel can be set into permanent position.
- 2.8 Internal cribbing/bracing must remain in place until the vessel is in its final position. After installation of the vessel, remove the cribbing and inspect the glass to insure the lining was not damaged during rigging or removal of the cribbing.
- 2.9 Glass-lined vessels should be leveled to prevent uneven strains, which could result in damage in the lining. Most agitators must operate in a fully vertical position to avoid drive or seal problems. These vessels should be carefully leveled on installation (see paragraph 7.0 in this section).

Figure 3

CAUTIONS

PHYSICAL FACTORS EFFECTING STRENGTH

Your care in the use and handling of slings will prolong sling life significantly. The following physical factors should be considered when using any of the three basic types of slings in this catalog:

Cutting – The number one cause of web sling damage/failure is usually caused by load edge movement against the sling.

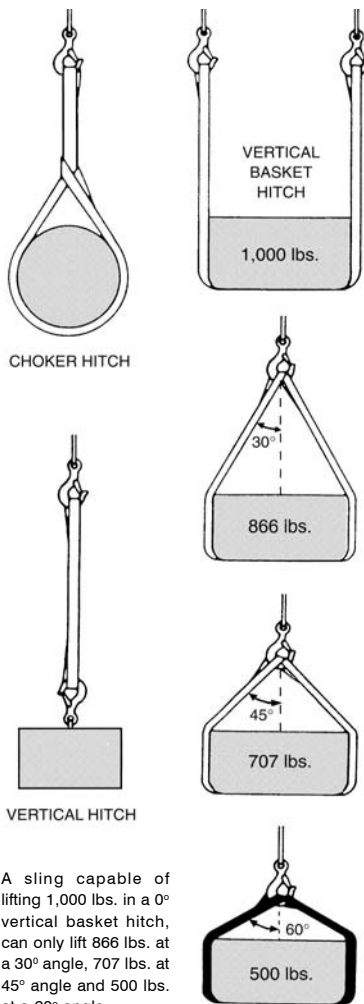
Temperature – Nylon & polyester are seriously degraded at temperatures above 200°F.

Improper Loading – Shock loading, unbalanced loading, over loading and inadequate consideration for the effect of angle factors can adversely effect strength.

Punctures & Abrasions – These can seriously degrade sling strength. Red core yarns can aid in locating damaged webbing.

Foreign Matter – Material such as metal chips, weld spatter, heavy grit, etc. can damage a web sling both internally and externally.

Ultraviolet Light – Nylon & polyester web slings are adversely effected by prolonged exposure to UV light, i.e. sunlight or arc welding. Slings appear bleached and stiff.



A sling capable of lifting 1,000 lbs. in a 0° vertical basket hitch, can only lift 866 lbs. at a 30° angle, 707 lbs. at 45° angle and 500 lbs. at a 60° angle.

EFFECTS OF ANGLE ON A SLINGS RATED CAPACITY

When slings are used at an angle (i.e. – two slings or one sling in a basket attached to only one crane hook), sling capacity is reduced. How much it is reduced depends on the degree of the angle. You can determine whether a sling will be rated high enough if you know the angle between the sling leg and the vertical. Once you know this angle, multiply the sling's rating by the appropriate factor in the table. This will give you the sling's reduced rating.

Angle Degrees	Factor
0	1.000
5	0.9962
10	0.9848
15	0.9659
20	0.9397
25	0.9063
30	0.8660
35	0.8192
40	0.7660
45	0.7071
50	0.6428
55	0.5736
60	0.5000
65	0.4226
70	0.3420
75	0.2588

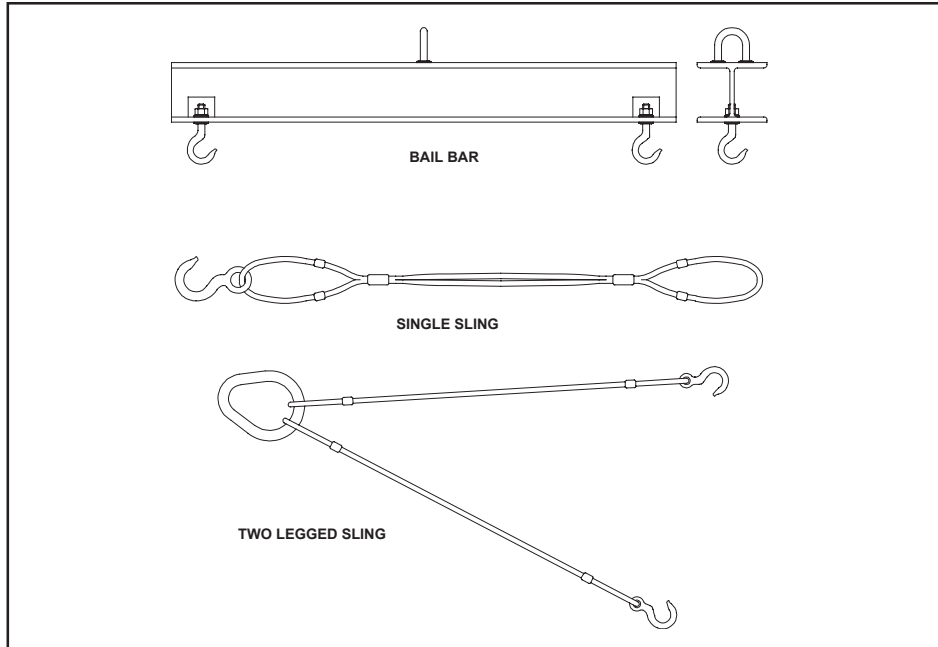
Sling capacity decreases as the angle from vertical increases.



3.0 Glossary of Terms (See Figure 4)

3.1 Bail Bar: A length of structural steel, usually an “I” beam, with a loop at the center of the top and a hook or a loop with a clevis at each end of the bottom.

Figure 4



3.2 Single Sling: A sling with a spliced eye loop at one end and a spliced eye loop and hook at the other end.

3.3 Two-Legged Sling: Two single slings connected by a link through their eye loops.

4.0 How to Handle SA and GL Series (Closed Welded) Reactors and Vertical Tanks

4.1 General

All De Dietrich SA and GL Series reactors and vertical tanks are equipped with two or four top head lifting lugs equally spaced and corresponding bottom head guiding lugs. Some reactors also have lifting lugs at the top of the jacket. Note that bottom head lugs are not intended for lifting but for use as guides to help control the rigging operation.

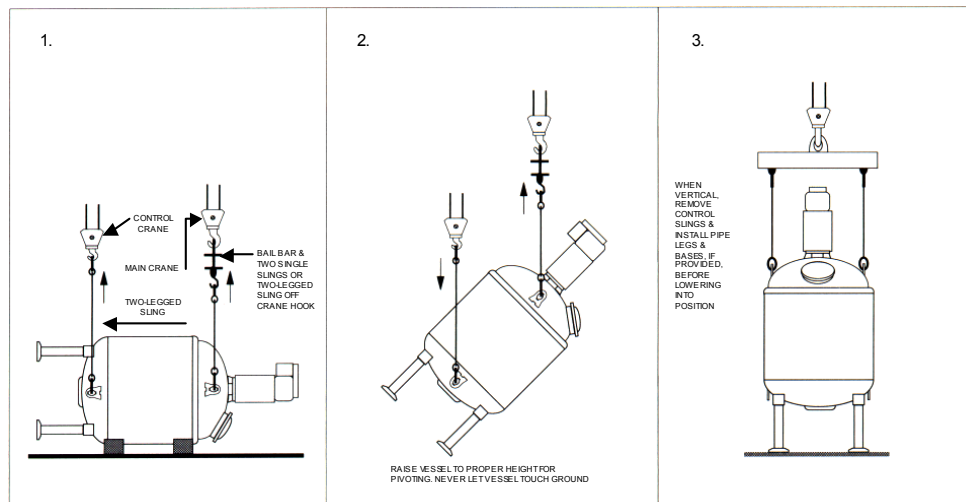
4.2 Preparing For the Lift

Observe all handling procedures in paragraph 2.0 of this section.

SA/GL Series reactors and vertical tanks are shipped in the horizontal position strapped in a wooden shipping cradle/skid. Be sure to free the vessel from the cradle before lifting. A main crane of sufficient capacity to handle the entire weight of the vessel must be provided. It is best practice to use a bail bar with two slings of proper strength, but a two-legged sling may also be used. Connect the bail bar or sling link to the main crane hook as shown in Figure 5. A second control crane or other lifting device must be provided to help control, handle, and keep the lower end of the vessel (the bottom head) in the air throughout the lift. Connect the link of a two-legged sling (preferred) or bail bar to the control crane hook and the sling hooks to the guiding lugs as shown in Figure 5.1 on page 9.



Figure 5



Lift the vessel in a horizontal position high enough to allow the control crane to start to lower the bottom head (see Figure 5.2) until the vessel top head has reached a fully vertical position (See Figure 5.3) The vessel must not touch the ground during this handling. When the vessel is vertical, remove the control slings and install support legs and bases if applicable. The vessel is ready for setting into position.



The hook of either the bail bar cables or two-legged sling should fit “freely” in the lifting and guiding lugs. If the hook is tight due to being too large as shown in Figure 6, remove the hook and use wire rope or nylon/ polyester slings between the hook and lifting/guiding lugs as shown in Figure 7.



Figure 6



Figure 7



4.3 Making the Lift (preferred)

Using both cranes in unison, start tensioning cables very slowly, allowing the vessel to roll in the wooden cradle/skid, then swing the lugs into a horizontal plane as shown in Figures 8 and 9.

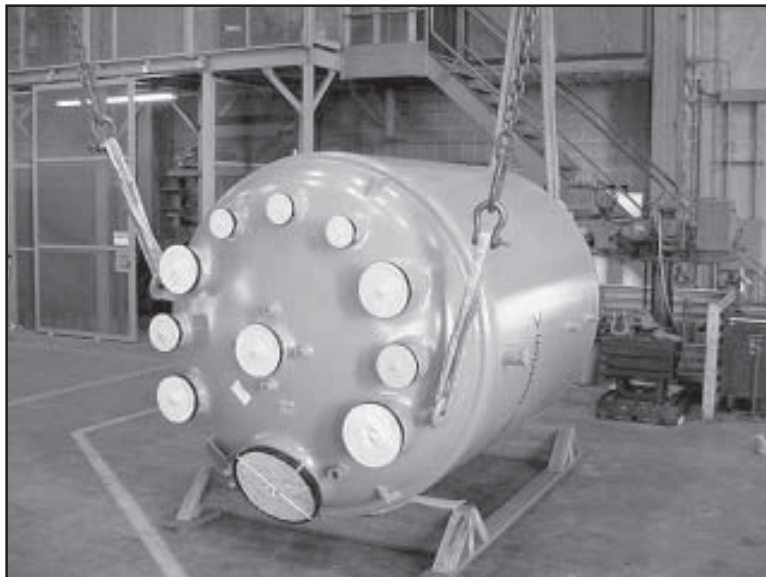


Figure 8

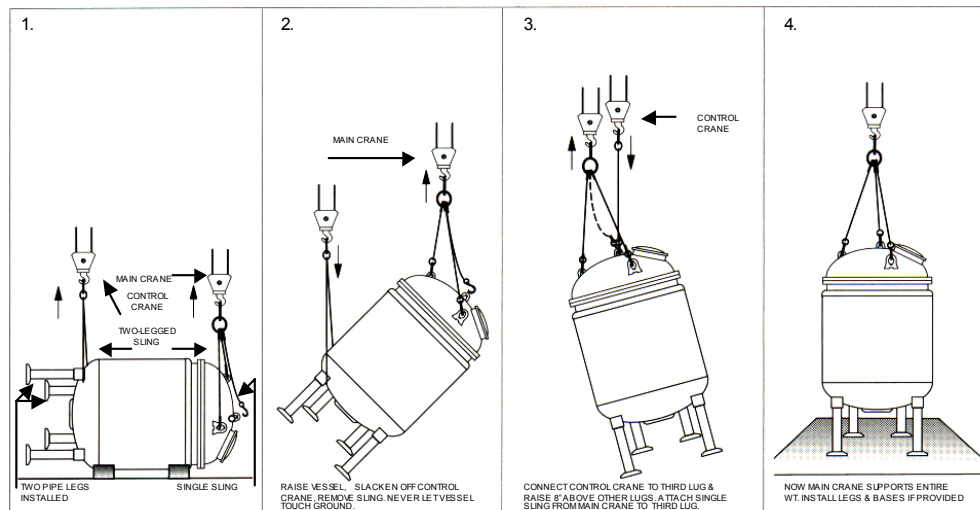


Figure 9



5.0 How To Handle CTJ Series Reactors (Clamped Top and Flanged Top)

Figure 10



5.1 General

All De Dietrich CTJ Series reactors are equipped with three top head lifting lugs, 120° apart, and two guiding lugs on the bottom head. All CTJ Series reactors also have three lifting lugs at the top of the jacket. Note that bottom head lugs are not intended for lifting but for use as guides to help control the rigging operation.

5.2 Preparing For the Lift

Observe all handling precautions in paragraph 2.0 of this section.

CTJ Series reactors with capacities of 100 gallons or less are shipped in the vertical position in an open wooden crate. Large sizes are shipped in the horizontal position strapped in a wooden shipping cradle/skid. Be sure to free the vessel from the cradle before lifting. A main crane of sufficient capacity to handle the entire weight of the vessel must be provided.

5.2.1 Reactors Shipped in Horizontal Position

Connect the link of a two-legged sling to the main crane or other lifting device and connect the sling hook or cable to the two top head lifting lugs on the reactor that are at the highest elevation. Connect a single sling having the same leg length as the legs of the two-legged sling to the main crane hook as shown in Figure 10.1. Secure the loose single sling to prevent it from accidentally bumping into the vessel. A second control crane or other lifting device must be provided to help control the handling and keep the lower end of the vessel (the bottom head) in the air throughout the lift. Fully engage two pipe legs or short pieces of threaded pipe in the two-legged couplings that are at the highest elevation. Connect the link of a two-legged sling to the control crane hook and the legs of each wire rope or nylon /polyester sling around the reactor leg couplings into which the pipes have been threaded. The slings should be positioned in a choker hitch so the loops will slip and tighten when the lift is made.

5.2.2 Reactors Shipped in Vertical Position

Connect the link of a three-legged sling to the crane or other lifting device and connect the sling hooks to the three lifting lugs on the top head of the reactor as shown in Figure 11.



Figure 11



5.3 Making the Lift

5.3.1 CTJ Reactors Shipped in Horizontal Position

Using both cranes in unison, lift the vessel in horizontal position high enough to allow the control crane to start to lower the bottom head until the control sling is loose (see Figure 10.2). Do not allow the vessel to touch the ground. Remove the control sling from the reactor leg couplings and control crane. Spin the vessel and connect the control crane hook to the vacant third top head lifting lug on the reactor. Slowly raise the control crane hook until the lifting lug to which it is attached is elevated approximately eight inches above the other two lifting lugs. Connect the free single sling secured to the main crane hook to the reactor lifting lug that is presently being supported by the control crane (see Figure 10.3). Lower the control crane hook and remove the hook from the reactor lifting lug. The main crane now supports the full weight of the vessel (see Figure 10.4). Install support legs and bases, if applicable. Set the vessel in position and level as outlined in paragraph 7.0 of this section.

5.3.2 CTJ Reactors Shipped in Vertical Position

Remove the top of the crate and the internal bracing to provide clearance to remove the vessel. Slowly raise the vessel high enough to clear the crate and install support legs and bases, if applicable. Carefully move and lower the vessel into position. Level the vessel as outlined in paragraph 7.0 of this section.



6.0 How To Handle Horizontal Tanks

6.1 General

Small horizontal tanks with up to a 14' 9" total length have two main lifting lugs located on the top of each head and four auxiliary lifting lugs located at 3 and 9 o'clock on each head. Large horizontal tanks with greater than a 14' 9" total length have four lifting lugs, two on each head, at 3 and 9 o'clock. (These tanks also have blanked-off lugs at 12 and 6 o'clock which are for factory use only and must not be used by the customer). **Horizontal tanks are shipped strapped in a wooden shipping cradle when leg or side lug supported.** When a wooden shipping cradle is used, the strapping must be removed before the tank is lifted. When shipped in steel saddles, the saddles should not be removed during tank installation.

6.2 Installing Small Horizontal Tanks

Observe all handling precautions in paragraph 2.0 of this section.

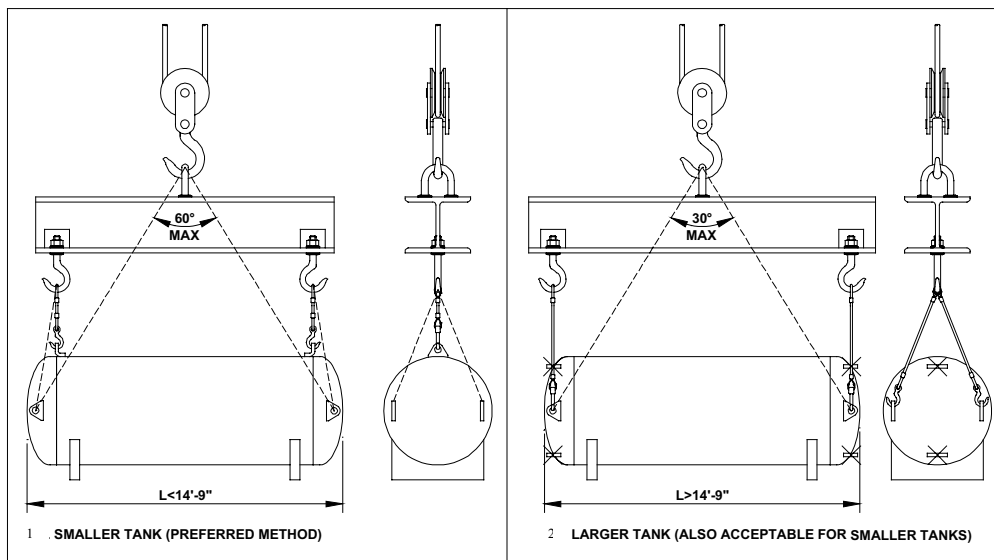
It is preferable to use a bail bar with two single slings of proper strength for making the lift. A two-legged sling may also be used with a maximum of 60° between legs at the crane hook. Use of the two main lifting lugs is preferred. (See Figure 12.1) Alternatively, the four auxiliary lifting lugs can be used employing a bail bar with (2) two-legged slings or (2) two-legged slings from a crane hook. With this arrangement, the maximum angle between sling legs is 30° and all four lugs must be used simultaneously. When the tank is lifted, install support legs and bases if applicable and set into position. Level the tank as outlined in paragraph 7.0.

6.3 Installing Large Horizontal Tanks

Observe all handling precautions in paragraph 2.0 of this section.

It is preferable to use a bail bar with (2) two-legged slings of proper strength for making the lift. An alternate (2) two-legged sling set-up may also be used with a maximum of 30° between the opposite two-legged slings. Both of these methods are shown in Figure 12. All four lugs must be used simultaneously. When the tank is lifted, install support legs and bases if applicable and set into position. Level the tank as outlined in paragraph 7.0.

Figure 12





7.0 Leveling The Vessel

CAUTION: ECCENTRIC LOADING OF SUPPORTS MAY CAUSE STRESSES OF SUFFICIENT MAGNITUDE TO RESULT IN IMMEDIATE OR DELAYED DAMAGE TO THE GLASS LINING. MAKE CERTAIN THAT ALL SUPPORTS CARRY AN EQUAL SHARE OF THE LOAD AT THE END OF THE LEVELING OPERATION.

7.1 Vessels with an Agitator/Drive System Installed

Most agitators must operate in a fully vertical position to avoid drive or seal problems. First, rough-level the vessel using a long spirit level at four points, 90° apart on the shell or jacket. Accomplish this by adjusting the threaded leg supports or by shimming the welded leg supports or side lug supports, whichever is applicable. Final leveling must be made using a torpedo level placed on the top surface of the drive stand at two points 90° apart, on the shell or jacket, using a long spirit level. Adjust threaded leg supports or shim welded leg supports or side lugs, whichever is applicable, as required. Locate and install anchor bolts, if required.

7.2 Vertical Vessels, Non-Agitated

Check the level of the vessel at four points, 90° apart, on the shell or jacket, using a long spirit level. Adjust the threaded leg supports or shim the welded leg supports or side lugs, whichever is applicable, as required. Locate and install anchor bolts, if required.

7.3 Horizontal Vessels, Non-Agitated

With a long spirit level, use the top or bottom of the vessel shell for longitudinal leveling and the largest top nozzle for radial leveling. Adjust the threaded leg supports or shim the welded leg supports or cradle, whichever is applicable, as required. Locate and install anchor bolts, if required.

8.0 Vessel Accessory Installation

8.1 General

In most situations, all specified accessories have been installed at our facility prior to shipment. When installing additional accessories or making necessary replacements, use the following guidelines to assist with these procedures.

8.2 Manway and Main Covers

On all openings, check the flange face for warpage (distortion/waviness). This procedure should be performed in accordance with Section IV of this document and our Technical Bulletin 1276.

CAUTION: DE DIETRICH RECOMMENDS ONLY AFII TYPE ENVELOPE GASKETS FOR GLASS-LINED STEEL NOZZLES AND FLANGES. OTHER TYPES OF GASKET CONSTRUCTION MAY NOT GIVE SATISFACTORY SERVICE AND MAY RESULT IN DAMAGE TO THE GLASS.

After shimming (if necessary), set the gasket on the flange face. A shimmed gasket must be properly oriented. Place the cover in position on the flange, noting correct orientation. Install the specified number of the correct size clamps. Tighten the clamps in the pattern with the recommended bolt torques as detailed in Section V.

DANGER: THE USE OF TOO FEW CLAMP ASSEMBLIES ON A DE DIETRICH PRESSURE VESSEL IS DANGEROUS AND MAY RESULT IN SEVERE PERSONAL INJURY, DEATH OR EQUIPMENT DAMAGE. DE DIETRICH SPECIFIES THE REQUIRED NUMBER OF CLAMP ASSEMBLIES NECESSARY FOR SAFE OPERATION BASED ON THE ASME PRESSURE VESSEL CODE. IT IS ESSENTIAL THAT ALL DE DIETRICH EQUIPMENT, BOTH NEW AND USED, FOLLOW THESE SPECIFICATIONS. IF YOU ARE UNAWARE OF THE REQUIRED NUMBER OF CLAMP ASSEMBLIES FOR DE DIETRICH EQUIPMENT, CONTACT DE DIETRICH WITH THE EQUIPMENT SERIAL NUMBER.



CAUTION: USING TOO FEW CLAMPS MAY REQUIRE EXCESSIVE TORQUE TO MAINTAIN SEAL PRESSURES. THIS CAN LEAD TO SERIOUS GLASS/GASKET DAMAGE.

8.3 Drive Assembly

For installation instructions, refer to the applicable De Dietrich technical bulletin.

8.4 Process Connections

CAUTION: PIPING CONNECTIONS TO GLASS-LINED STEEL NOZZLES MUST BE SUCH THAT NO EXTERNAL LOADING IS PLACED ON IT. THE USE OF EXPANSION JOINTS AND PIPE HANGERS ARE STRONGLY RECOMMENDED.

NOTE: The installation of PTFE nozzle liners to all service nozzles will provide additional protection to the glass-lined surface against thermal shock, corrosion and erosion.

DANGER: IF THE VESSEL IS TO BE OPERATED UNDER INTERNAL PRESSURE, CONNECT A PROPERLY DESIGNED SAFETY RELIEF DEVICE AND A PRESSURE GAUGE TO ONE OR MORE TOP OPENINGS. ON JACKETED VESSELS, MAKE SURE A SUITABLE JACKET PRESSURE RELIEF VALVE HAS BEEN INSTALLED. REFER TO ASME BOILER AND PRESSURE VESSEL CODE, SECTION VIII, DIVISION 1, AND PARAGRAPH NG-125. FAILURE TO DO SO COULD RESULT IN SEVERE PERSONAL INJURY, DEATH, OR EQUIPMENT DAMAGE.

CAUTION: WHEN TIGHTENING BOLTED OR CLAMPED JOINTS, BE CAREFUL TO AVOID STRAINS THAT COULD POSSIBLY DISTORT THE STEEL SUBSTRATE AND CAUSE DAMAGE TO THE GLASS LINING. USE ONLY THE BOLT TORQUES RECOMMENDED IN SECTION V IN CONJUNCTION WITH THE CORRECT NUMBER OF CLEAN LUBRICATED SA-193-B7 BOLTS AND SA-194-2H NUTS, THE PROPER TIGHTENING SEQUENCE AND THE RECOMMENDED DE DIETRICH AFII TYPE GASKETS.

9.0 Jacket Piping Connections

9.1 General

The temperature range in which a glass-lined pressure vessel may be used frequently depends on the chemical process service. For complete information on safe operation temperatures, refer to De Dietrich Bulletin 3009 Glass.

9.2 Heating and Cooling Media

Steam is customarily used for temperatures up to those permitted by the maximum jacket pressure /temperature rating.

CAUTION: ALTERNATING STEAM AND HOT WATER CAN CAUSE "WATER HAMMERING" WHICH MAY RESULT IN DAMAGE TO THE GLASS LINING.

Heat transfer fluids are employed for temperatures within the limitations of the glass-lined steel pressure vessel. These limits are clearly stamped on the attached ASME Code nameplate. Heat transfer fluids usually give better temperature control than steam or other vapor media with reduced corrosive tendencies.

Water should be treated to remove impurities and should contain a corrosive inhibitor.

Brine may be used for cooling, but must be kept at a neutral pH. The recommended brine concentrations should have a specific gravity of 1.2 and a pH of 8.0 – 8.5. Sodium dichromate in the amount of 1 lb./100 gal should be added. Never use brine alternately with steam or hot water. This can result in a highly corrosive condition.

Ammonia, glycerol, ethylene glycol, etc., may be used as alternate coolants or heat transfer fluids.



DANGER: NEVER USE AMMONIA ALTERNATELY WITH STEAM OR HOT WATER

CAUTION: SOME COOLANTS MAY DECOMPOSE TO ACID COMPONENTS WHEN EXPOSED TO HEAT/STEAM, LEADING TO CORROSION OF BOTH THE VESSEL AND JACKET STEEL. THIS TYPE OF ATTACK COULD POTENTIALLY CAUSE A GLASS LINING FAILURE DUE TO NASCENT HYDROGEN DISPERSION.

NOTE: Check the nameplate for minimum operation temperature at rated pressure.

9.3 Jacket Piping Connections

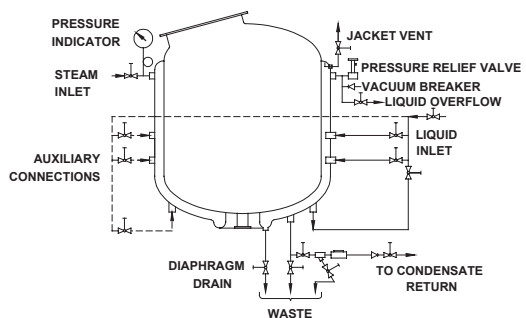
De Dietrich jacketed vessels are equipped with service connections of 150 lb. ANSI flanges and/or 3000 lb. couplings to afford rigid support for the service lines. These connections are adequately sized for the service flows for the particular size vessel.

Aside from the regular inlets and outlets, all De Dietrich jacketed vessels are equipped with a vent coupling at the top of the jacket shell and a drain coupling in the lower jacket expansion diaphragm near the vessel outlet. The recommended practice is to connect the top vent line with a valve and vent whenever liquid is first injected into the jacket. This removes all air and permits full heat transfer. It also prevents corrosion of the upper closure. The diaphragm drain should be periodically “blown down” to remove sludge from the expansion ring, to prevent premature failure due to corrosion. Agitating nozzles are available for certain jacket couplings to give direction and turbulence to the flow of liquid medium only. They are not to be used for vapor medium such as steam. All jacket couplings are provided with stainless steel impingement plates to protect the inner shell from erosion and direct contact of the heating or cooling medium.

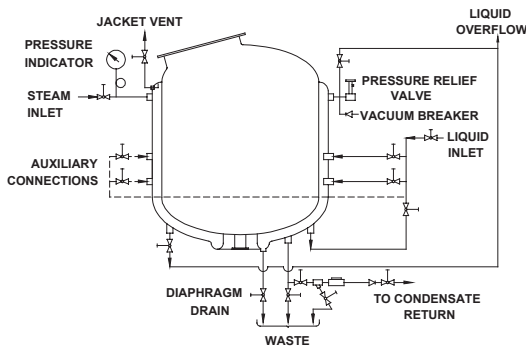
SERVICE HOOK-UP

Figure 13

Plan “A”



Plan “B”



The two hook-ups “A” and “B”, shown above in Figure 13, are typical arrangements where both vapor and liquid service connections are required. Plan “B” may be used where brine, steam and water are used in the jacket. This arrangement will permit the removal of scale and rust. Periodic drainage of the expansion ring should be practiced.



Provide reliable temperature control instrumentation to prevent thermal shock damage to the glass lining due to excessive temperature differentials. The use of a liquid heat transfer medium is recommended to minimize this potential.

CAUTION: DO NOT CHARGE FULL-PRESSURE STEAM INTO A COLD VESSEL. USE PRESSURE STAGING TO ALLOW TIME FOR THE BOTTOM HEAD AREA TO REACH AN EQUILIBRIUM.

10.0 Start-up Inspections

10.1 Removal of Internal Bracing

After the vessel is erected, leveled and secured, the internal bracing for the agitator shaft must be removed. Following established OSHA Confined Space and company safety procedures, prepare the vessel for entry. Use only wooden, fiberglass rope, or rigid ladders to enter the vessel. All personnel entering the vessel must remove all loose articles from their pockets and belts with large metal buckles. Required footwear must be either clean, dedicated sneakers or rubber totes. Rubber, foam or felt matting should be placed on the bottom head to protect the glass lining during removal of the bracing.

10.2 Spark Test/Visual Inspection

Remove all protective matting from the bottom head. Using only a 5 to 6 kv approved tester, spark test the glass lining of the vessel and accessories. No other type of tester is recommended. Carefully inspect the entire glass surface for any chips or fractures, which may have occurred during removal of the bracing and/or assembly of the accessories and process connections.

CAUTION: A SMALL CHIP OR EVEN A PINHOLE, IF NOT REPAIRED, CAN LEAD TO CORROSION OF THE STEEL SUBSTRATE. THIS MAY RESULT IN SEVERE EQUIPMENT DAMAGE.

10.3 Drive and Mechanical Seal

All drives, except the Lenze model offered on small CTJ reactors, are **shipped without oil**. For lubricant requirements on the Series 60 drives refer to Technical Bulletin 788-3, and on the PTE drives refer to Technical Bulletin 980-1. Determine if the mechanical seal is designed for wet or dry-running operation (wet seals are provided with Model 600 lubricators). Wet seals require a lubricant, which is compatible with the chemical process in the reactor. Typical specifications are SAE 10/20 grade, 0.5 to 10 cps and rated for above the maximum operating temperature.

CAUTION: SOME LUBRICANTS MAY NOT BE COMPATIBLE WITH THE ELASTOMERS USED IN THE MECHANICAL SEAL. THE REACTION MAY RESULT IN A SWELLING OR DETERIORATION OF THE O-RINGS, CAUSING PREMATURE FAILURE. CONSULT DE DIETRICH TO REVIEW THE POTENTIAL EFFECTS WHEN USING A DESIRED LUBRICANT.

The dry-running seal requires no liquid medium as a lubricant. A flow of nitrogen or instrument air provides the necessary cooling and pressure for the mechanical seal's rotating faces.

DANGER: USING COMPRESSED AIR FOR DRY-RUNNING SEALS MAY SHORTEN THE EXPECTED LIFE OF THE EQUIPMENT AND RESULT IN SEVERE EQUIPMENT DAMAGE.

All mechanical seals must be pressurized to provide a differential above the maximum process pressure in the vessel. Recommended differentials are 15-20 psig above for wet running mechanical seals and 5-10 psig above for dry-running mechanical seals.



10.4 Pressure Test

Rotate the agitator shaft by hand to make sure it is free. This can easily be performed by turning the motor coupling. Attach a dial indicator on the agitator shaft, just above the mechanical seal housing. Energize the starter and measure the shaft run-out and confirm that the agitator rotates counterclockwise as viewed from the top of the vessel. Acceptable run-out on the Series 60 drive is 0.010" and acceptable run-out on the PTE drive is 0.007". Check with De Dietrich for specifications on other models.

Fill the vessel with water and perform a hydrostatic pressure test to check for gasket leakage. Do not exceed the design pressure.

DANGER: THE MECHANICAL SEAL MUST BE PRESSURIZED WITH THE RECOMMENDED DIFFERENTIAL PRIOR TO HYDROSTATIC PRESSURE TEST OF THE VESSEL. FAILURE TO DO SO MAY RESULT IN MECHANICAL SEAL, HOUSING AND/OR AGITATOR DRIVE END DAMAGE.

Pressure check all heating, cooling and plugged jacket connections for leaks. Confirm all bolt torques (see Section V). Retorque after the first operation cycle.

SECTION III: PREVENTIVE MAINTENANCE

1.0 General

- 1.1 With a proper preventive maintenance program, the life of your glass-lined steel vessel can be extended over a long period of time. Glass-lined steel is a tough material but it must be maintained properly and periodically. A regular inspection program with early detection of damage in the lining can help to prevent a major failure of your vessel. An early warning continuous surveillance system of the glass-lining is an invaluable asset to the user. De Dietrich offers our GlasGuard Model AZ as protection against a major failure. (See Bulletin 116). In addition to maintenance, cleanliness of the equipment and the area in which it is located will help to extend the life of the vessel.

2.0 Maintenance Checklist

- 2.1 A preventive maintenance checklist should be prepared listing all the areas that are to be maintained and a time schedule for these procedures. Depending upon the severity of the process the time intervals for these inspections will vary. Initially an inspection every six months should be instituted if at all possible. Keeping accurate records of the inspection procedures will help evaluate the results of the inspections. De Dietrich offers a Preventive Maintenance Contract program that covers all required inspections with written reports available to the user.

The checklist should include the following:

1. Vessel appearance internally
 - a. Spark test
 - b. Glass thickness test
2. Mechanical seal and lubricator (if applicable)
3. Motor and drive performance
4. Vessel nozzle connections
 - a. Condition of gaskets
 - b. Condition of connecting bolts and clamps
5. Vessel appearance externally
6. Vessel jacket connections
 - a. Agitating nozzles
 - b. Relief valve



2.2 Internal Inspection

The glass lining should be inspected visually for any signs of loss of fire polish, corrosion, or erosion (especially the agitator blades and the baffle). In addition, the lining should be spark tested (see De Dietrich Bulletin 883 or 185) for any signs of glass lining failure. Finally, the glass thickness measurements should be taken randomly and more detailed in areas that are questionable in appearance. Details of these tests are listed in paragraph 3.0 of this section.

DANGER: DO NOT ENTER A VESSEL WITHOUT FIRST PREPARING IT FOR SAFE ENTRY, IN ACCORDANCE WITH OSHA'S CONFINED SPACE ENTRY PROCEDURES. FAILURE TO DO SO CAN RESULT IN SERIOUS INJURY OR DEATH.

- 2.3 Inspect the mechanical seal and lubricator (if applicable), which includes changing the lubricant as required. Inspect the mechanical seal as per De Dietrich Bulletins 782, 880, 980, 1070 and 1184.
- 2.4 Inspect the motor and drive, which includes oil change and lubrication as mentioned in De Dietrich Bulletin 980-1 (for PTE drives) and Bulletin 788-3 (for Series 60 Drive).
- 2.5 Check all gasketed connections and re-torque or replace leaking gaskets as required. For torque values, see Section V of this bulletin as well as information concerning the proper gaskets. Check the condition of all clamps and bolts and lubricate as required. Use Never-Seeze® (or equivalent) to lubricate threads.
- 2.6 Inspect the outside of the vessel for chemical spillage. Any spills should be immediately neutralized then flushed thoroughly with water and dried. The vessel should be repainted as required. Clean the inside of the jacket periodically, being sure to drain the lower diaphragm (should be drained weekly). (See paragraph 3.8 of this section for cleaning the jacket).
- 2.7 Remove, clean and inspect the jacket agitating nozzles in jacketed vessels. They should be replaced when required. Check any pressure relief devices on the jacket as well as the vessel. Be sure they are in good working condition. Check the vessel externally for any signs of corrosion, especially on the jacket closure rings. Repaint as required. Check all connections to jacket nozzles including expansion joints and piping supports.

3.0 Inspection, Testing and Protection of the Glass Lining

3.1 Visual Inspection

3.1.1 Carefully inspect the entire glass-lined surface for signs of loss of fire polish, chipping, or staining.

3.1.2 Use a lighted magnifier to help identify signs of potential early failure of the lining.

CAUTION: A SMALL CHIP OR PINHOLE, IF NOT REPAIRED IMMEDIATELY, CAN LEAD TO THE CORROSION OF THE STEEL SUBSTRATE. THIS MAY RESULT IN SEVERE EQUIPMENT DAMAGE.

3.1.3 Check old repair plugs – if any of them are loose, replace them. Do not retighten them.

3.1.4 Be sure to include inspection of the agitator and baffles. Look for signs of erosion as well as corrosion, especially on the leading edge of the agitator blades.



3.2 Electrical Testing

Spark test the entire glass lining surface including accessories per De Dietrich Bulletin 883 or 185 using De Dietrich GlasTron DC6000 or Model 6000 E (AC) spark testers. The use of either one of these units will assure that the proper voltage is being applied to the glass lining surface. All vessels should be spark tested after installation using the maximum 6000 volt tester. The DC model is the preferred system, however, for agitator blades such as the GlasLock® type, the AC tester must be used. Make repairs as required (see paragraph 3.5.1 of this section).

3.3 Glass Thickness Measurement

Measuring the glass thickness is critical to the life of the vessel. Periodic measurements of the lining should be taken using a magnetic induction or eddy current type instrument with an accuracy of at least $\pm 5\%$. The vessel should be mapped in a grid type of arrangement with readings taken every 24-36" apart. Areas that exhibit loss of fire polish should be more thoroughly inspected and monitored. Agitator blades and baffles are more likely to show signs of wearing and therefore require a thickness test more frequently. When the glass thickness reaches 0.028" contact your De Dietrich representative.

3.4 Record Log

It is recommended that a log be kept for each vessel indicating the date of installation, spark testing results, visual inspection results and glass thickness results. This log will help determine the estimated service life of the vessel and could help to prevent a failure of the vessel.

3.5 Glass Repair

3.5.1 Field Repair

Any damaged areas no matter how small, should be immediately repaired. There are many different methods of repair such as tantalum repair plugs, patches or sleeves as well as PTFE repair sleeves (KwikFix™ and KwikSleeve™) that can be used to successfully repair damaged areas of the lining. De Dietrich's highly qualified Technical Service Specialists are available to perform the repair.

3.5.2 Reglassing

For those vessels where it is no longer economical to field repair, De Dietrich offers our reglassing service at our state of the art facility in Corpus Christi, Texas. Vessels will have all the glass-lining removed, will be weld repaired (and modified if required) and then be completely relined with our 3009 highly corrosion resistant glass lining. Contact your local De Dietrich representative to help determine if your vessel is reglassable. A reglassed vessel will have the same glass lining warranty as a new vessel.

3.6 Returning Equipment for Repair/Reglassing

In order to avoid delays in the repair and reglassing of your vessel, please adhere to the following procedures:

1. Clean the vessel and jacket thoroughly, removing all chemicals and heat transfer fluids.
2. Remove all insulation.
3. Remove all accessories not subject to repair or replacement such as the agitation system, clamps, split flanges, pipes, valves, fittings, etc.
4. If necessary, call a De Dietrich representative to pre-qualify the vessel.
5. Prepare the vessel for shipment.
6. Obtain an R/M number (Return Material Number) and Return Equipment Questionnaire, for each major item, by calling De Dietrich.



7. Indicate the R/M number on the equipment being shipped as well as on all shipping documents and your purchase order. The vessel must have a legible nameplate.
8. Complete the Return Equipment Questionnaire, return it along with MSDS sheets for the vessel and jacket, and send them to De Dietrich in Union, NJ.
9. Ship the equipment freight prepaid to Corpus Christi, TX.

3.7 Acid Spillage on the Outside of the Vessel

Acid spillage can cause major damage to unjacketed areas of a vessel due to hydrogen dispersion resulting in loss of the glass lining.

3.7.1 Precautions

1. Protect the exterior of the vessel
2. Try to minimize spillage
3. Immediately neutralize any spillage and thoroughly wash the exterior with water

3.7.2 Protecting the Exterior of the Vessel

1. The top head of a vessel can be protected with a metallic shield especially if the top head is insulated. If it is not insulated, a suitable coating such as zinc rich epoxy or other chemical resistant systems are available.
2. De Dietrich offers a drip ring arrangement located above the jacket top closure ring that can be supplied on new or reglassed vessels. This drip ring does not allow seepage into the insulation when washing material away from the vessel. It also can be used as the top ring for insulation.
3. A procedure that is becoming more common is sheathing the vessel jacket area or the entire vessel in carbon or stainless steel.

3.7.3 Minimizing Spills

1. Avoid spillage on the top head while charging material to the vessel by using removal charging chutes (rubber or PTFE).
2. Periodically check all flange connections to avoid leakage.
3. Use the proper gaskets at all nozzle connections.
 - a. Use the proper torque for all bolting (clamps as well as bolts). Be sure all bolting is properly lubricated and is bolted in the proper sequence.
4. If any spillage does occur immediately neutralize and wash off.

3.8 Jacket Cleaning

Jackets of vessels are subject to fouling due to a build up of deposits from heating and cooling. As reactor jackets become fouled with iron oxide corrosion, production is negatively effected. Over time, internal fouling of the jackets in glass-lined steel reactors reduces heat transfer efficiencies, increases reaction times and decreases yields by as much as 15%. Periodic inspection of the jacket will extend the life of your vessel, and only De Dietrich provides one or more jacket clean-out ports specifically for this purpose. When it is determined that the jacket must be cleaned, we recommend one of the following:

1. De Dietrich has aligned with Nalco Company to provide the most comprehensive reactor jacket cleaning service currently available to industry - **Restor™**. Developed by Nalco Company, and tested and approved by De Dietrich, cleaning compound **GLRx™** quickly and safely removes iron oxide build-up from the jackets of glass-lined steel reactors. It works without damaging the glass lining or dissolving the base metal of reactors. Request Bulletin 548 for additional information.
2. Contact De Dietrich Process Systems and/or Nalco Company for instructions and procedures on jacket cleaning with Restor™ and GLRx™. * (GLRx and Restor are trademarks of the Nalco Company).
3. For mild fouling, especially due to brine usage, we also recommend a 15% solution of sodium hypochlorite (see Table 1 for jacket capacities).



Table 1

REACTOR JACKET CAPACITY IN GALLONS (Conventional jackets only)

Model Number	Jacket Capacity Gallons	Model Number	Jacket Capacity Gallons
CTJ-14-5	3	GL & SA-300	73
CTJ-14-10	6	GL & SA-500	100
CTJ-20-20	8	GL & SA-750	135
CTJ-20-30	12	GL & SA-1000	162
CTJ-24-50	17	GL & SA-1500	210
CTJ-32-100	32	GL & SA-2000	240
CTJ-40-200	46	GL & SA-3000	328
CTJ-48-300	61	GL & SA-4000	386
CTJ-54-500	113	GL & SA-5000	352
CTJ-60-500	120	GL & SA-6000	407
CTJ-60-750	172	GL & SA-8000	473
CTJ-66-1000	187	GL & SA-10,000	895
CTJ-84-2000	247		

- NOTE: A 3/4" coupling is normally installed on the lower jacket diaphragm. A drain valve should be connected to this coupling. This drain valve should be opened at least once a week during operation to clean out all accumulated deposits.

CAUTION: NEVER USE ACID SOLUTIONS, INHIBITED OR OTHERWISE FOR CLEANING JACKETS OF GLASS-LINED EQUIPMENT.

- Inspect all jacket-agitating nozzles after cleaning the jacket and replace them if needed.

3.9 Storage

For outdoor storage or areas that are not heated, precaution must be taken to protect glass-lined steel equipment.

- In areas where the temperature will fall below freezing, all jackets must be drained and plugged to prevent water entry. Where complete drainage is not possible, anti-freeze such as ethylene glycol should be added to the jacket.

CAUTION: FOR A SPLIT PIPE COIL VESSEL (HEMICOIL® TYPE) ALL COILS MUST BE COMPLETELY DRAINED

- Use a minimum number of well-lubricated clamps for storage - the rest of the clamps should be stored indoors in a dry, environmentally controlled area.
- All vessel nozzles should be covered tightly with rubber caps.
- All threaded connections should be coated with Never-Seeze® (or an equivalent).
- Cover the baffle to prevent moisture from entering.



6. If the vessel is stored with an agitation system check Bulletin 980-1 (PTE Drives), Bulletin 788-3 (Series 60 Drive) for correct storage of the drive and motor.
7. Inspect the exterior of the vessel periodically and repaint with zinc rich epoxy paint as required.
8. Individual agitators or baffles should be stored in a dry environmentally controlled area.

SECTION IV: SHIMMING WITH DDPS PTFE ENVELOPE TYPE GASKETS

1.0 General

- 1.1 De Dietrich PTFE envelope type gaskets are standard on all De Dietrich glass-lined equipment. Current design gaskets are comprised of a corrugated 304 stainless steel metal ring between two compressible asbestos-free insert rings, all surrounded by a PTFE envelope.

CAUTION: THIS COMPOSITE SHOULD NEVER BE REPLACED WITH ONE OF A DIFFERENT TYPE UNLESS APPROVED BY DE DIETRICH. SUBSTITUTIONS MAY RESULT IN GLASS DAMAGE DURING TORQUING OR DUE TO LEAKAGE.

As a result of high temperature during the lining process, the glass-lined flanges may warp slightly. Most frequently, the amount of warpage is insufficient to cause a sealing problem. If the gap between mating flanges exceeds 1/16" at any point around the circumference, the gasket must be shimmed to reduce the possibility of leakage and prolong the service life of the equipment. Factory supplied gaskets installed on new vessels are shimmed, if required, prior to shipment from the factory. If a factory-shimmed gasket was supplied, shimming must be repeated when replacing the gasket in the field (per Bulletin 1276).

SECTION V: RECOMMENDED BOLT TORQUES

1.0 General

- 1.1 The torque values shown in Table 2, 3, and 4 are based upon the following:
 1. The use of new well lubricated nuts and bolts for nozzles up to 12", larger openings will usually use clamps.
 2. The use of Type AFII PTFE envelope gaskets.
 3. The torque values for clamps will be valid for up to 300 PSI.

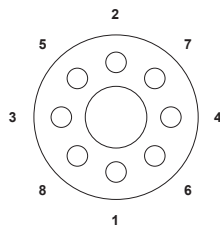
1.2 Conditions

1. Recommended torques are for standard PTFE AFII Type gaskets.
2. Torque values are for nuts, bolts and clamps meeting the following ASME specifications.
 - a. Bolts ASME Spec. SA-193 Grade B7
 - b. Nuts ASME Spec SA-194 Grade 2H
 - c. Clamps ASME Spec SA-449
3. All torque values are for nuts and bolts that are free flowing and well lubricated. For situations where lubrication cannot be tolerated, consult De Dietrich.
4. All torque values apply to initial tightening and re-torquing after use.



1.3 Bolting Procedure

1. All flange faces must be parallel with enough room for equal tightening.
2. The use of a torque wrench is strongly recommended so that torque values will not be exceeded.
3. All bolts should be first tightened by hand, then bolts should be tightened $\frac{1}{2}$ turn at a time following the sequence shown below.



NOTE: In connection with the sequence in which the bolts are tightened, it is important that the total amount of final stress desired be applied in small increments, otherwise distortion of the flanges may occur regardless of the sequence followed. Retighten all bolts and clamps after one operating cycle or after at least 24 hours at rest.

Table 2

RECOMMENDED BOLT TORQUES¹ (FOOT-POUNDS) FOR ANSI CLASS 150 STANDARD BOLTING

NOZZLE SIZE	BOLTS ^{2,3} NO.	SIZE (in)	WITH AFII GASKETS	
			MIN	MAX.
1	4	1/2	20	30
1 1/2	4	1/2	20	30
2	4	5/8	35	55
3	4	5/8	35	65
4	8	5/8	35	70
6	8	3/4	55	100
8	8	3/4	55	110
10	12	7/8	70	140
12	12	7/8	70	140

REFERENCE NOTES:

1. Torques are recommended for well-lubricated bolts.
2. ASME Spec. SA-193, Grade B7; identified by "B7" stamped on the bolt head.
3. ASME Spec. SA-194, Grade 2H nuts; identified by "2H" stamped on the top surface.

**Table 3****RECOMMENDED BOLT TORQUES¹ (FOOT-POUNDS)
FOR ANSI CLASS 300 STANDARD BOLTING**

NOZZLE SIZE	BOLTS ^{2,3} NO.	SIZE (in)	WITH AFII GASKETS	
			MIN	MAX.
1	4	5/8	40	50
1 1/2	4	3/4	70	80
2	8	5/8	40	60
3	8	3/4	70	100
4	8	3/4	70	100
6	12	3/4	70	100
8	12	7/8	110	140
10	16	1	170	230
12	16	1 1/8	240	300

REFERENCE NOTES:

1. Torques are recommended for well lubricated bolts.
2. ASME Spec. SA-193, Grade B7; identified by B7 stamped on bolt head.
3. ASME Spec. SA-194, Grade 2H nuts; identified by 2H stamped on top surface.

Table 4**RECOMMENDED BOLT TORQUES¹ (FOOT-POUNDS)
FOR CLAMPS^{2,3} AT VESSEL PRESSURES UP THROUGH 300 PSIG**

CLAMP SIZE (in.)	WITH AFII GASKETS	
	MIN.	MAX.
3/4 ⁴	40	65
7/8 ⁴	85	110

REFERENCE NOTES:

1. Torques are recommended with well-lubricated bolts.
2. Clamps are used in place of bolts on nozzles with flanges larger than 12". The number and size of the clamps depends on the vessel's internal pressure and the size of the opening.
3. ASME Spec. SA-449, identified by "Y" or SA-449 stamped on the J-Bolt.
4. De Dietrich strongly recommends lubrication to reduce variable binding and corrosion of the fastener.



SECTION VI: RECOMMENDED SPARE PARTS

1.0 General

Many operating plants have a policy to have readily available spare parts in their storage department. These parts can consist of recommended and optional items. The items and quantities are normally determined based upon the severity of the process and the number of operating units of like size for part's interchangeability.

1.1 Highly Recommended Spare Parts:

1. AFII Gaskets – full set
2. Sight glass
3. Mechanical seal cartridge
4. Bottom outlet valve
5. Agitator shaft (retreat curve or GlasLock®)
6. GlasLock® blade
7. Baffle

1.2 Optional Spare Parts:

1. Jacket agitating nozzle
2. Replacement temperature sensor (DR for baffle or SVR for valve)
3. Valve seat
4. Valve stem
5. Manway protection ring
6. Manway cover
7. Main cover (if applicable)
8. Drive parts listed in Bulletin 788-3 or 980-1
9. Any components clearly identified by De Dietrich as a special (unique in design and/or materials) are strongly recommended to be stocked by the end user as an on-site spare.

1.3 How to Order

When ordering spare parts include the following information:

1. Vessel size and type
2. Vessel serial number obtained from the nameplate
3. Complete description of the part ordered with a part number when available.
4. Quantity of the part to be ordered



REPLACEMENT PARTS

Agitators

- GlasLock® Agitator Shafts: Single or Multiple Tiers
- GlasLock® Blades: Flat Turbine, Hydrofoil, Rushton, Low Level Trapezoidal, High Viscosity
- Retreat Curve Impellers
- Chevron Agitators for conical vessels

Baffles

- BeaverTail™ Baffles: Flanged or Holder Mounted
- Baffle Holders
- Temperature Sensors: RTD or Thermocouple
- Tantalum Baffle Tips
- Dip Pipe/Baffle Combination

Clamps & Split Flanges

- Forged Zinc - Chromate Plated
- Nickel Plated
- 316L Stainless Steel

Covers

- Main Vessel Covers
- Manway Covers
- Manway Protection Rings: Glass-Lined or PTFE
- EasyLift™ Manway Cover Assists

Dip Pipes

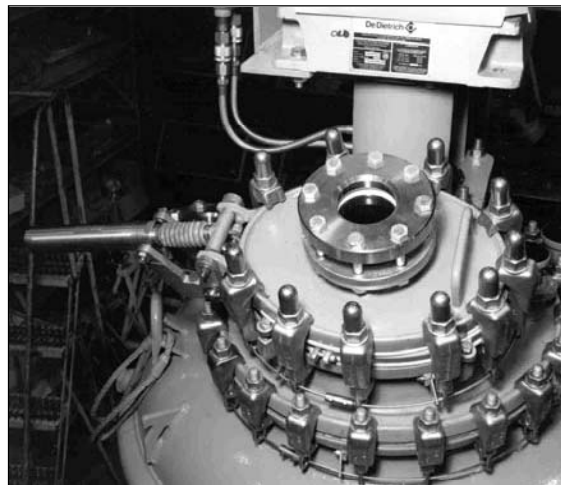
- Glass-Lined
- PTFE or Halar Lined
- Hastelloy or other alloys

Drives

- De Dietrich Series 60
- Philadelphia PTE Drives
- Lenze: Single Speed or Mechanically Variable with hand-wheel

Gaskets

- Type AFII Split Envelope
- U and Channel-Cut
- Special Fillers Available





STOCKING PROGRAMS

- Glass-lined agitators, baffles and covers
- Gaskets, clamps and bolting hardware
- Seals and seal parts
- Tantalum and PTFE repair parts for glass-lined equipment
- Glass process piping and components
- Valve and pump parts
- Drives and drive parts
- Multi-layer filter media
- Control and hydraulic systems components

SUPPORT SERVICES

- Custom training seminars
- Rental equipment for on-site pilot plant test work
- Reglassing old vessels
- Repairing glass and glass-lined vessels
- Refurbish filters and dryers to nearly new condition
- Rebuilding drives, seals and pumps
- On-site inspection and repair
- Jacket cleaning
- Field service personnel located across the United States for quick response
- Installation and start-up assistance



DDPS stocks a comprehensive range of replacement parts and provides numerous services to optimize performance and minimize downtime of its equipment for many years after the sale. DDPS' wide range of services includes upgrading and refurbishing existing filters, dryers and gas-handling systems; repairing or reglassing damaged or worn out glass-lined parts and vessels; and providing a variety of preventive maintenance services. The DDPS in-house capabilities include replacing/rebuilding wear parts and seals; restoring interior and exterior finishes; completing major vessel and hardware repairs; and updating control and hydraulic systems. DDPS' team of experienced service engineers often performs repair and maintenance services on equipment while it is installed in the process plant.

Top: Installation supervisor

Center: Reactor inspection and maintenance

Bottom: Reglassing a reactor

UNITED STATES
908 686 4900
704 587 0440

FRANCE
33 3 88 53 23 00

SWITZERLAND
41 61 925 11 11

GERMANY
49 61 31 97 04 0

GREAT BRITAIN
44 1785 609 900

IRELAND
353 61 366925

SOUTH AFRICA
27 11 918 4131

BELGIUM
32 16 40 5000

NETHERLANDS
31 765 42 15 44

SPAIN
34 93 29 20 520

SINGAPORE
65 861 1232

CHINA
86 21 5351 1817

BRAZIL
55 11 6703 7380



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