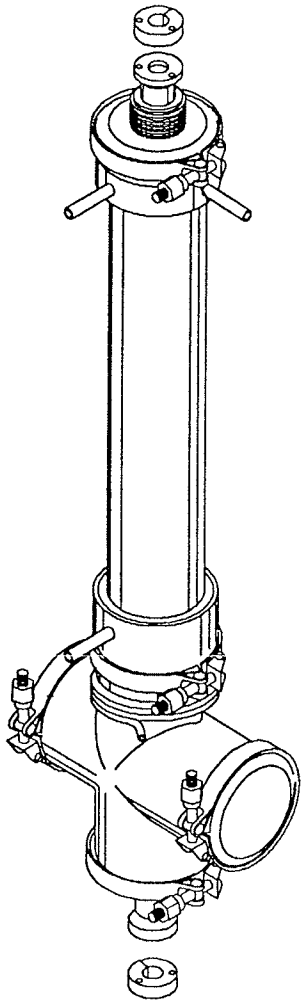

SERIES 3910 RETORT

ATS501 3/92

INSTRUCTION MANUAL ATS 501 4/92

SERIES 3910 RETORT

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Information you supply may be used by ATS without obligation. Necessary changes will be made in future editions of this manual.

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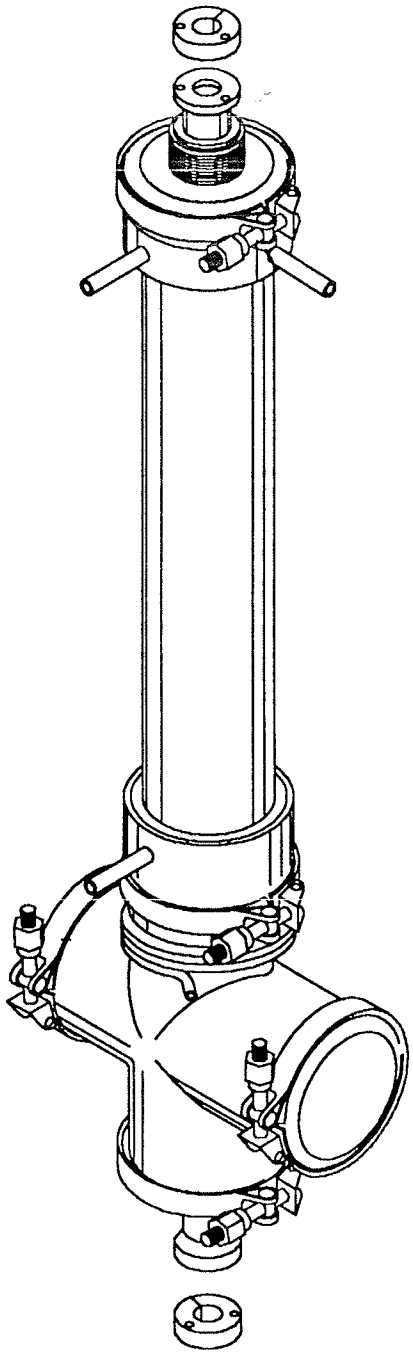
SECTION 1. INTRODUCTION

The ATS Series 3910 - 3920 Retort is a compact test chamber used to test specimens in a vacuum or controlled gas atmosphere. The retort is usually fitted to a matching furnace. Series 3910 is of integral construction while series 3920 is of interchangeable flange construction. Refer to Instruction Manual ATS502 for information specific to the series 3920 retorts.

The retort is constructed of a metal, ceramic, or quartz tube with water cooled flanges on each end for the attachment of end caps. The end flanges can be of removable construction or welded to the retort tube (metal retorts only). The removable end flanges permit interchangeability of retort tubes of the same outside dimensions. The end cap assemblies contain the gas ports, thermocouple sealing glands, and pull rod seals. There are two types of pull rod seals: the packing gland and the bellows seal assembly. The packing gland consists of multiple v - ring seals with pull rod travel limited by the sealing surface on the pull rod. The bellows seal has a double o - ring seal where one end is attached to the pull rod and the other end of a bellows welded to an end cap. The travel range of the bellows seal is limited to the travel of the bellows. Retorts that are not used with load trains may have one end closed and have a removable end cap on one end only. Retorts with extensometers may have accessory chambers to house the extensometer measuring devices (LVDT, LVC, etc.). These chambers are usually water cooled to protect the measuring device and may include the ports for other functions. The accessory chamber may be either a tube type or cross type.



SERIES 3910 INCONEL RETORT
w/ cross type accessory chamber
& bellows type pull rod seal

SAFETY

WARNING: Be careful when working with elements at elevated temperatures. There is a danger of burns. Wear protective clothing and refer to manuals that come with the furnace for safe operation.

WARNING: Be careful when opening the oven to access the retort. Items with a large mass retain heat for a long time. It is not necessary to touch hot surfaces to be burned. Heated elements can produce first degree burns (similar to sunburn) from heat radiation.

CAUTION: ***PREVENT DAMAGE TO THE RETORT*** - by locating the moving and stationary members in relation to each other. Calculate pull rod travel needed for test for each end of the retort. Compare the retort seal method, bellows or packing, with the expected required range. The expected travel must be less than the limits of the sealing method to prevent damage to the retort.

CAUTION: Do not overheat the retort. Observe maximum temperature ratings.

CAUTION: Observe heat up rate when using ceramic retorts.

CAUTION: Set up load train with stops to prevent damage to retort and extensometer in the event of specimen failure.

CAUTION: Use only Teflon insulated wire to connect readout equipment in accessory chamber.

CAUTION: Do not use furnace to support retort except on horizontal applications - always support retort with mounting brackets.

CAUTION: Do not operate retort without all retort water cooling lines connected and flowing water. Damage to the seals may result.

SPECIFICATIONS

Specifications vary depending on material and design.

Series 3910 Retorts are of integral construction and may be of closed end or tubular construction. Flanges are integral part of tube with removable end cap(s).

Series 3920 Retorts have interchangeable slip - on flanges permitting retort tubes to be interchanged.

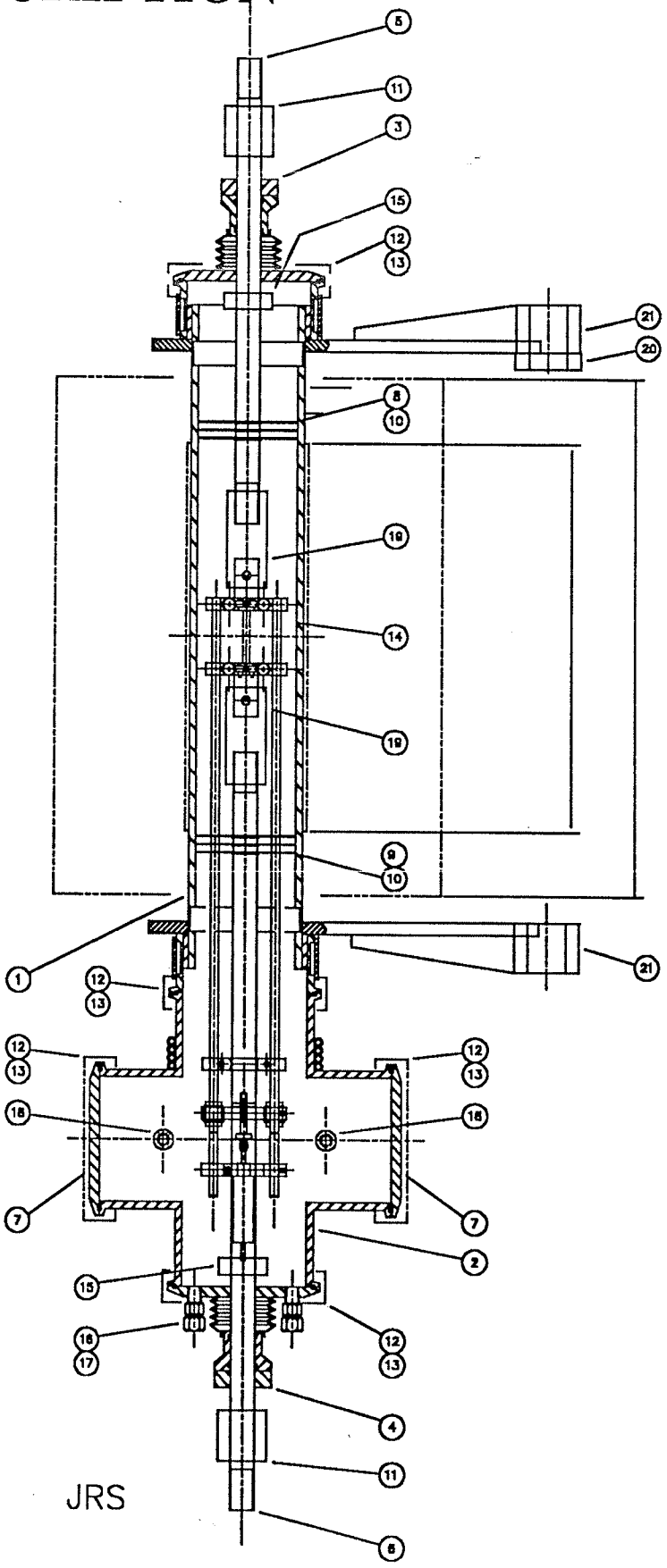
Materials may be a combination of any of the following:
Inconel, Stainless Steel, Ceramic (alumina or mullite) or Quartz

Maximum temperature:
Inconel - 1100^0 C
Ceramic - 1600^0 C (Alumina 998)

CAUTION: **Maximum *SYSTEM* temperature will be limited to the element with the lowest maximum temperature rating.**

SECTION 2. DESCRIPTION

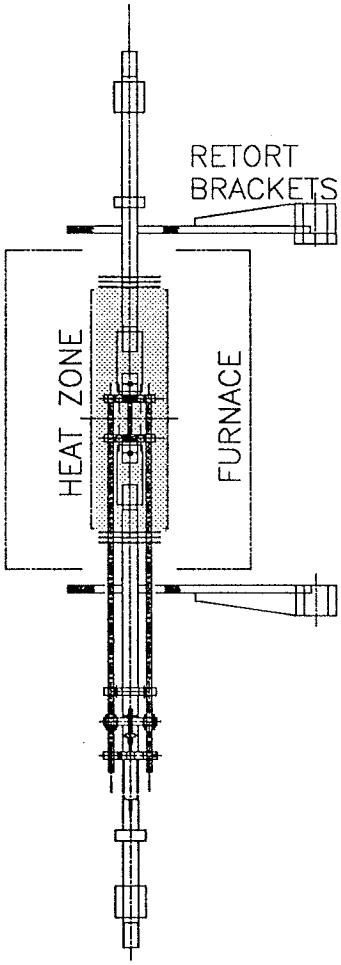
1. Retort tube subassembly
2. Extensometer chamber
3. Upper bellows assembly
4. Lower bellows assembly
5. Upper water cooled pull rod
6. Lower water cooled pull rod
7. Cap
8. Upper radiation shield
9. Lower radiation shield
10. Inconel clip
11. Water coupling
12. Retort clamp
13. Gasket (Viton)
14. Extensometer Assy.
15. Split collar
16. Thermocouple gland
17. Sealant
18. LVDT wiring connection
19. Coupling
20. Collar
21. Retort mounting bracket
22. Vacuum valve
23. Tube



General Drawing
Review Specific Retort Assembly Drawing for more information.

SECTION 3. INSTALLATION

Refer to the assembly drawings and bill of materials for the parts layout and nomenclature. Operating data peculiar to each retort is available from the assembly drawing. For retorts with removable end flanges, refer to ATS5XX for special procedures and cautions.



1. Install complete load train in testing machine without retort to check out assembly length. Check specimen position with reference to placement of furnace and retort mounting brackets. After establishing position of load train, retort, and furnace, record measurements to use as a guide for final assembly.

CAUTION: PREVENT DAMAGE TO THE RETORT - by carefully locating the moving and stationary members in relation to each other. Calculate pull rod travel needed for test at each end of the retort. Compare the travel range of the retort seal method, bellows or packing, with the expected required range. The expected travel must be less than the limits of the sealing method to prevent damage to the retort.

2. Thoroughly clean all parts of retort, load train, extensometer, and specimen with a suitable cleaner or solvent to remove any oil film or contaminants.

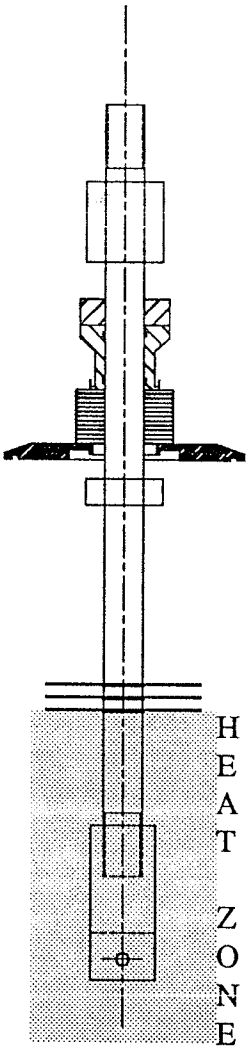
3a. Upper end cap assembly (packing gland type).
Assemble packing in gland. Apply a light film of high quality vacuum grease on seals, place sealing edge of v-rings toward higher pressure for the best seal. Refer to upper end cap and packing gland assembly drawing for assembly of v-rings. Use the vacuum grease to lubricate the parts of the threads on the upper pull rod that will contact the sealing elements during assembly. Insert the pull rod through the upper end cap/packing gland assembly. Be careful not to damage the seals.

3b. Upper end cap assembly (bellows type).
The O-ring seal contains twin O-rings. For best performance, both O-rings must be in place and free of irregularities (cuts, scratches, or breaks). Apply a light film of high quality vacuum grease on the O-ring seals. Refer to upper end cap and bellows assembly for placement of seals. Loosen the collar locking screw and the collar to ring seal mounting screws to facilitate assembly of the upper pull rod through the upper end cap/bellows assembly. Use the vacuum grease to lubricate the parts of the threads on the upper pull rod that will contact the sealing elements during assembly. Insert the pull rod through the upper end cap/bellows assembly. Be careful not to damage the O-rings.

4. Position the upper end cap on the upper pull rod.

NOTE: On end caps with bellows assemblies, locate the end cap and bellows collar on the pull rod

to allow the required bellows travel. Tighten the collar locking screw and the collar to O-ring seal mounting screws. Install and position the split collar stop in the retort end of the pull rod/end cap assembly to prevent bellows overextension. Tighten the split collar locking screw and check bellows movement. Refer to the assembly drawing for permissible travel range.



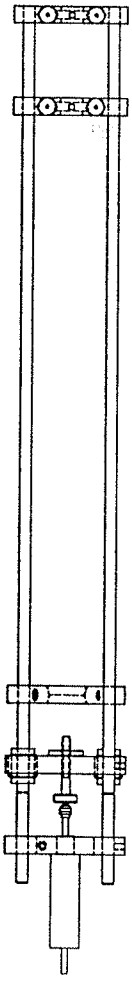
5. Make sure the O-ring seals are in the water cooling collar and install it on the pull rod. Align the water flow holes in the collar with the water flow holes in the pull rod.

6. Place the upper heat radiation seals in position on the pull rod assembly and lock each shield in place with the inconel wire lock rings.

NOTE: The upper heat shields usually have three holes for thermocouples, and three shields to a set. Refer to assembly drawings.

7. Assemble upper hot coupling and specimen onto the upper pull rod assembly.

8. Begin extensometer assembly by removing gaging platforms and rod guide assembly. Position the extensometer crossheads on the specimen and attach at the desired gage length.



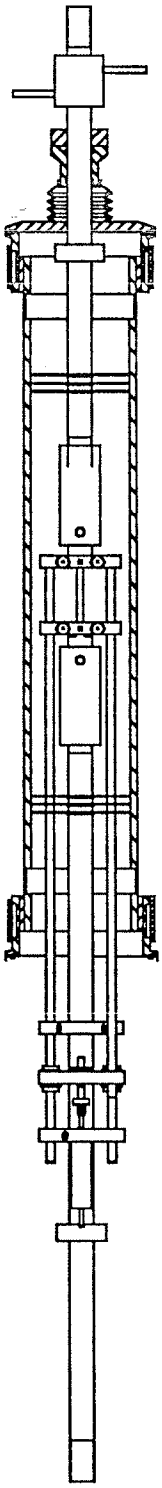
9. Assemble lower hot coupling onto the specimen. Hold the lower pull rod with the turned down threads pointing downward. Check the assembly of the radiation shields. Align the holes in the heat shields for the extensometer rods and slide the shield/pull rod assembly up through the lower hot coupling.

10. Reassemble gaging platforms and the rod guide assembly on the extensometer.

NOTE: The rod guide should be positioned as far from the heated zone as possible without interfering with the movement of the gaging platforms.

CAUTION: Do not use the rod guide to support the radiation shields and never use the rod guide in the heated zone.

11. Detach the extensometer crossheads from the specimen and check the travel of the extensometer to check for freedom of movement. Correct as required. Reattach the extensometer crossheads to the gage length. Be sure they are tight enough that they will not slip once the test begins.



12. Assemble thermocouples on the specimen if desired. Align the holes in the upper radiation shields. Insert the thermocouples through the shields and Conax sealing gland fittings on upper end cap assembly. Allow wire loop to provide for specimen movement.

NOTE: Check location of upper packing gland assembly and spiral thermocouple leads around pull rod to allow for rod movement. Assemble Conax sealing gland and tighten. Refer to Conax instruction sheet.

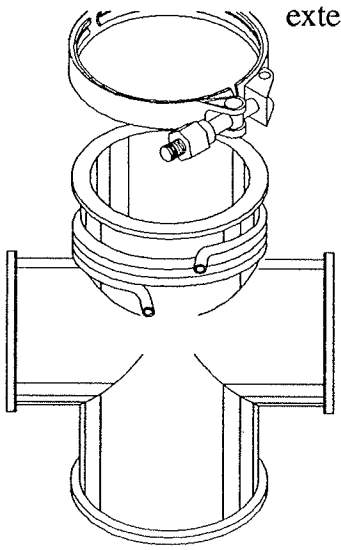
13. Check and adjust the position of the extensometer gaging platforms as required to provide access for the zero adjusting screws on the LVDT core rods and to provide adequate LVDT travel. Refer to retort assembly drawing for the position of the gaging platforms.

14. Check the following before lowering the load train assembly into the retort:
a. Location of radiation shields should be just outside the heat zone of the furnace. Clearance between retort inside diameter and radiation shield outside diameter should be less than 0.125 inch (3.17mm).
b. Specimen: Centering and crosshead attachment tightness.
c. Positioning of specimen in center of heated zone.
d. Attachment of specimen thermocouples and routing of leads to permit movement.

15. Carefully lower the load train assembly through the top of the retort. Install flange clamp on upper end cap and flange and tighten clamp.

16. Install calibrated LVDT or other device in the extensometer gaging platforms. Zero the LVDT.

17. Install flange seal and retort accessory chamber over lower portion of load train and clamp in place. Check and adjust the position of the extensometer gaging platforms if required. Connect the LVDT leads to the Conax sealing fitting assembly. Check for correct polarity.



18a. Lower end cap assembly (packing gland type). Assemble packing in gland. Apply a light film of high quality vacuum grease on seals, place sealing edge of v-rings toward higher pressure for the best seal. Refer to lower end cap and packing gland assembly drawing for assembly of v-rings. Use the vacuum grease to lubricate the parts of the threads on the lower pull rod that will contact the sealing elements during assembly. Insert the pull rod through the lower end cap/packing gland assembly. Be careful not to damage the seals.

18b. Lower end cap assembly (bellows type).
The O-ring seal contains twin O-rings. For best performance, both O-rings must be in place and free of irregularities (cuts, scratches, or breaks). Apply a light film of high quality vacuum grease on the O-ring seals. Refer to lower end cap and bellows assembly for placement of seals. Loosen the collar locking screw and the collar to ring seal mounting screws to facilitate assembly of the lower pull rod through the lower end cap/bellows assembly. Use the vacuum grease to lubricate the parts of the threads on the lower pull rod that will contact the sealing elements during assembly. Insert the pull rod through the lower end cap/bellows assembly. Be careful not to damage the O-rings.

19. Using measurement data from preliminary assembly, locate the lower end cap on the lower pull rod next to the end flange. Tighten the clamp.

NOTE: On end caps with bellows assemblies, position the split collar stop on the retort side of the pull rod / cap assembly to prevent bellows overextension. Tighten the split collar lock screw and measure the available bellows movement. Refer to the assembly drawing for the actual travel range measurements. Locate the end cap and bellows collar on the pull rod to allow the required bellows travel. Tighten the collar locking screw and the collar to O-ring seal mounting screws.

20. Check the O-ring seals in the water cooling collar and install on the pull rods. Align the water flow passages the collar with the water flow holes in the pull rods. Lock in place.

21. Complete lower load train connection.

22. Clamp and seal all remaining flanges and ports. The retort chamber may now be evacuated, purged, or backfilled as required for testing. When using a retort for vacuum service, connect a vacuum line to the guard vacuum ports on the upper and lower packing gland assemblies in addition to the main vacuum port. Proceed with testing after checking vacuum or pressure integrity of system.

23. Connect all water cooling ports and lines in series with hose or tubing. Run water flow from bottom areas to top. Provide approximately 0.25 - 0.50 G..P.M. water flow through the retort system with fittings connected in series. A water flow alarm may be connected on the discharge side to indicate low water flow. Adjust flow to keep discharge water temperature below 130 degrees F. if possible.

CAUTION: We recommend the use of metal tubing to route the water flow around the furnace.

SECTION 4. OPERATION

Follow the installation instructions each time a specimen is installed. It will not be necessary to readjust stops and elements of the load train when specimens are identical. Only partial disassembly of the major retort components will be required to access the specimen. Refer to the extensometer manual for zero procedures each time a specimen is changed. Refer to appropriate furnace manual for operation of the furnace. Observe all cautions outlined in the furnace manual.

CAUTION: Do not overheat the retort. Observe maximum temperature ratings.
CAUTION: Do not operate retort without all retort water cooling lines connected and water flowing.

SECTION 5. MAINTENANCE

RETORT AND ACCESSORY CHAMBER COMPONENTS

PACKING GLAND SEALS - Check packing gland seals or o-rings for proper installation. Replace if badly deformed, cracked, or nicked. Inspect the pull rod surfaces for scratches. Polish if necessary.

RADIATION SHIELDS - Inspect shields and retaining clips after each test. Check for fit and condition of metal. Replace if severely oxidized or bent.

RETORT FLANGE GASKETS - Check retort flange gaskets for deterioration or damage. Check flange sealing surfaces during each test assembly for damage. Replace seals as required. Polish flange sealing surfaces if necessary.

THERMOCOUPLE/LVDT/LVC GLAND SEALS - Replace sealant when re-using fittings.

EXTENSOMETER COMPONENTS

CROSSHEADS - Check crossheads, inserts, bolts and nuts for damage or deterioration. Replace as required.

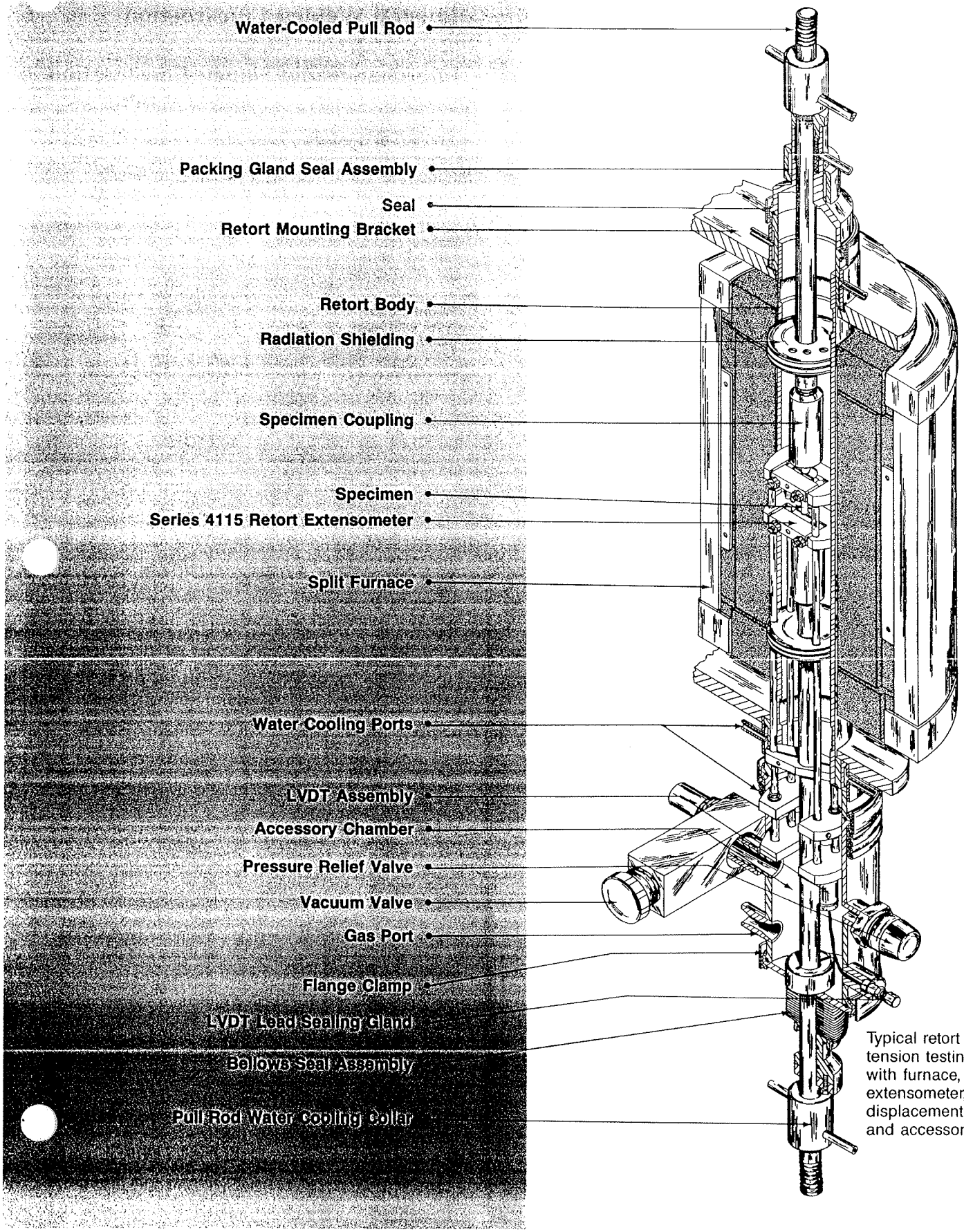
ROD BEARINGS - Check extensometer movement. Clean or replace rod bearings as needed to provide free axial movement. Check rods for straightness if movement is uneven.

SECTION 6. GLOSSARY

LVDT - linear variable displacement transducer

LVC - linear variable capacitance transducer

retort components



Typical retort assembly for tension testing. Shown with furnace, load train, extensometer, LVDT displacement transducer and accessory chamber.