Type-C Turbines

WESTINGHOUSE ELECTRIC

INSTRUCTION BOOK 6125 (Rev. 4)

All requests for General Information, Prices and Service should be addressed to the nearest Sales Office of the Company, as listed on the next-to-last page of this publication.

In the event that it becomes necessary to return any part of this equipment to the South Philadelphia Works, it should be tagged with the Sender's name and address and the serial number of the unit. Shipments by freight, express or parcel post should be addressed to:

Westinghouse Electric & Manufacturing Company
South Philadelphia Works
Essington, Pa.

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LIST OF ILLUSTRATIONS

Westinghouse Steam Turbines
Type C
DESCRIPTION

General Description

The turbines described herein are of the impulse type, consisting of one or two Curtis stages with two rows of rotating blades and one row of stationary blades in each. The field of application is that of either mechanical or generator drive, and the turbines can be connected to the driven apparatus either directly or through a reduction gear. Longitudinal sections through the C-Type turbines are shown in Figures 2, 3, 4, 5 and 6.

Steam enters the turbine through a single governing valve which, in addition to being under control of the main governor, is also under control of an overspeed trip mechanism in such a manner that it will close instantaneously if the turbine overspeeds a predetermined amount. From the governing valve, the steam passes into the nozzle chamber from which it expands through the nozzles, thus transforming the heat energy into velocity energy.

After passing through the first row of rotating blades, the steam is re-directed by the stationary blades into the second row of rotating blades and then passes out into the exhaust line.

Turbine Casing

The casing consists of a base and cover, bolted together at the horizontal joint. Steam inlet and exhaust connections are made to the base, so that the cover can readily be removed for a complete inspection of the internal parts. When removing the casing cover, it must be lifted straight up sufficiently to clear the rotor blades. Before replacing the cover, scrape the joint faces clean and make up with a good joint compound. We have found that best results can be obtained by the use of an unvulcanized rubber graphite packing which has been dissolved in gasoline. A suitable paste can readily be prepared by cutting this packing which comes in sheets, into small pieces and dissolving it over night in gasoline, using a proportion of 1 quart of gasoline to each pound of packing. The can should be well-covered so as to prevent evaporation. The resulting paste should be applied lightly to the joint, after which it should be pulled down tightly, as promptly as possible.

In the larger sizes the turbine is supported at the exhaust end by a separate pedestal which is anchored to the foundation, soleplate or bedplate and in turn, is bolted to lugs which are cast integrally with the casing base near the horizontal joint. The inlet end is supported by a channel or an I-beam section placed transversely so that the flexibility of the I-beam web provides adequately for longitudinal expansion and contraction resulting from temperature changes which occur with changes in load.

In the case of the two smallest frames (C-14 and C-20), in which the physical dimensions of the unit are such that the effect of differential expansion are relatively unimportant, the entire turbine is supported on feet cast integrally on the casing base.

Rotor

The rotating element, consisting of a shaft, one or two discs and the governor, or governor driving gear is carried in two ring-oiled bearings. The discs are shrunk on and keyed to the shaft. The inlet end of the shaft carries the overspeed trip body, and the exhaust end is machined to suit the coupling used to connect the driven apparatus.

Casing and Rotor (For Integral Gear Units)

When the C-14 or C-20 frames are used in connection with integral gears (described in I.B. 6368) the turbine casing is not fitted with a coupling end bearing bracket but the housing of the gear is bolted directly to the turbine cylinder base, the rotor shaft is made integral with the gear pinion and is supported by the two pinion bearings instead of by a coupling-end turbine bearing as in the usual application.

The turbine cylinder feet and the gear housing foot form a three point support for the combined unit. The construction is indicated in Figure 7.

Nozzles and Stationary Blade Holder

The nozzle block and the stationary blade holder are located in the casing base. The nozzle block is bolted to the steam chest body and the stationary blade holder, in turn, is bolted to the nozzle block. When assembling the turbine or checking the adjustments, the axial position of the rotor should be adjusted, by means of the thrust bearing, so that the stationary blades are central between the first and second rotating rows.

According to the requirements of the individual application, the turbine may have one, two or three nozzle groups, each group consisting of one or more nozzle passages. One group will always be under the control of the governor valve alone, whereas the others will be under the control of one or two hand valves, located in the steam chest body, and accessible from the side or front of the turbine. The steam passes through these hand-controlled valves, but is under the control of the governor-actuated valve at all times.

Interstage Diaphragm

In the case of the two-stage (C-225) unit, the nozzles for the second impulse stage are carried in the interstage diaphragm. The stationary blade holder for this stage is secured to the diaphragm in a manner similar to that used in fastening the first stage stationary blade holder to the nozzle block.

Leakage along the shaft where it extends through the diaphragm is reduced to a negligible quantity by the use of a labyrinth seal.

The nozzles may be provided entirely around the diaphragm or they may be provided around only a part of the circle, the number being dependent on the design conditions. In case nozzles are provided in only one half, the other half is made in the form of a blank.

The diaphragm is split in the horizontal center plane and the joint faces are carefully finished to form a steam-tight joint. The halves are kept in accurate alignment by means of keys which are secured in the lower half and engage keyways provided in the upper half.

The upper and lower halves are fitted in grooves machined in the cylinder cover and base respectively. A small radial clearance is allowed between the diaphragm and the bottom of the groove, and crushing pins spaced around the outer circumference, maintain the accurate position of the diaphragm and absorb any differential expansion between the diaphragm and the cylinder. Accurate finish of the outlet face of the diaphragm and groove prevents steam leakage at this point.

The two halves of the diaphragm are held in the cylinder by retaining screws at the horizontal joint. When raising the cover of the turbine, it should be borne in mind that the diaphragm will be raised with it, and it is important that the lift be straight upward to avoid damage to the adjacent blades. In this construction the seal strips are carried in a separate ring or retainer.

These seals consist of thin tapered fins machined integrally in the seal ring. Since the strips are thin at the sealing edge slight rubs between them and the shaft are negligible. Hence they can be set with close running clearance without any sacrifice of reliability. The number of seals per ring varies with design conditions, and two or more rings may be used if conditions warrant.

The ring is made in halves and is carried in a groove machined in the stationary parts. Each half is backed by a garter spring to hold it in the correct position with relation to the rotor. Rotation is prevented by suitably placed stop pins. Accurate finish of the low-pressure side of the groove and ring provides a steam-tight joint at this point.

Bearings

The bearings for low-temperature service are of the cast-shell, horizontally-split type, lined with tin-base babbitt. Lubrication is provided by the conventional type of revolving rings. These rings dip in oil in the bearing brackets and carry it to the top of the journals. Both bearings are of the same general type, the only difference being that the inlet end bearing has the ends babbitted and grooved for oil passage, thus forming a combined journal and thrust bearing. Thrust collars which are attached to the shaft, ride against the babbitted ends of the thrust bearing and thus hold the rotor in its correct axial position.

The clearance in these bearings, between the journal and the babbitt, should be between .004 and .007 inch.

The total clearance between the thrust collars and the ends of the bearing, that is the axial clearance (or end play), should be between .005 and .010 inch. This clearance can be varied by adjusting the shims which are placed back of the thrust collars. Increasing the thickness of the shims decreases the thrust clearance. Decreasing the thickness of the shims increases the thrust clearance. Shifting shims from one collar to the other changes the axial clearance between the stationary and rotating blades.

For turbines in high-temperature service a different type of bearing is used provided with means for forced circulation of oil to insure adequate heat removal. These bearings are made in halves of solid high-lead-content bronze.

The feature of special importance is the provision made for the circulation of oil by means of a special arrangement of grooves in the bearing, so that the journal acts as a pump, sucking the oil from the reservoir beneath the bearing, and discharging it under slight pressure to an external cooler, from which it is again returned to the reservoir. Excepting for the special grooving, the method of lubricating the bearing remains the same as that in general use in turbine practice.

The force required to produce the circulatory movement is provided by the action of the viscosity of the oil causing a film to adhere to the journal which drags it along through the grooves to the outlet passage. A conventional oil ring in each bearing provides the necessary priming for starting up and insures continuity of lubrication until the unit comes completely to rest in shutting down.

Glands

Leakage of steam at the points where the rotor shaft passes through the cylinder is reduced to a minimum by glands of the conventional carbon-ring type. The gland cases are split horizontally to facilitate dismantling and assembling.

The number of rings employed depends upon the operating conditions, varying from a normal of five to as many as eleven when very high back-pressure is encountered.

The carbon rings are made in three segments to insure a good fit on the shaft, and the ends are fitted so that a radial clearance of .002 to .005 inch on the diameter exists between the carbon and the shaft when cold. It is essential that the joints at the end of the segments be perfectly square and radial to prevent leakage at these points. Each ring is carried in a separate groove and is held around the shaft by a garter spring which holds the ends of the segments together. Each ring is prevented from rotating by a key in the casing which engages a slot in the carbon ring. If the gland is dismantled, it is important to re-assemble the segments in the same grooves and in the same relative positions as found originally.

When fitting the packing rings, every precaution must be taken to see that they are free to move radially in their individual grooves. If the rings are tight in the grooves, they will wear rapidly and in extreme cases may injure the shaft. The axial clearance necessary to insure this freedom of movement should be from .026 to .038 inch.

The condition of the glands with respect to the prevention of escape of steam to the atmosphere is extremely important because if any appreciable amount of blow-through is permitted, contamination of the oil supply is certain to occur, and this may lead to serious damage or at best, to excessive maintenance cost.

Whenever the discharge of steam from the gland leak-offs becomes excessive, and especially if steam begins to blow out from the ends of the glands, they should be dismantled and the ring cavities and the carbon rings carefully cleaned. (In doing this be careful not to mar the inner periphery of the ring). If the radial clearance has become too great it can be restored to its original value by very slight and judicious grinding of the ends of the segments, being sure to grind them squarely.

If, in spite of careful maintenance, any considerable escape of steam to atmosphere is noted, the rings should be promptly renewed.

As shown in the illustration, there are two openings for pipe connections in each gland case. These should be connected as follows:

For Non-Condensing Operation

1. **The opening at bottom of the gland case serves as a steam leak-off and drain and should be connected to some point very close to the turbine and at atmospheric pressure, where a slight amount of escaping steam is not objectionable.**
2. When sealing against moderate pressure, the opening in the top or at the side of the gland case should be plugged. When sealing against high pressures, this opening is used as an additional leak-off and should be connected to a feed heater or otherwise arranged so that the heat of the leak-off steam can be conserved.

For Condensing Operation

1. The opening at the top of the gland case serves as a steam inlet and should be connected to a supply of low-pressure steam which serves as the sealing medium.

2. The opening at the bottom serves as a drain and steam leak-off and should be connected to some point, close to the turbine, at atmospheric pressure where a slight amount of escaping steam is not objectionable.

Governor and Overspeed Mechanism

The turbine is provided with a speed control governor and with an overspeed trip mechanism. Both devices actuate the steam chest valve, but in addition "Dual Control" is obtained by having the overspeed trip actuate also an independent butterfly valve in the steam line to the unit. These devices are described in detail in separate instruction leaflets furnished for each application.

INSTALLATION

General

It is very important that the machine be installed properly. Misalignment, distortion of the bedplate or soleplate or other errors of this kind may later bring about serious operating troubles even though the unit appears to run satisfactorily at first. It is desirable to have the bedplate or soleplate as nearly level as possible, but in any case it is absolutely necessary to have the rotating shafts in proper alignment as determined by the couplings, regardless of the levels. In order to emphasize this point, on machines which are shipped assembled with the driven apparatus on a continuous bedplate, the coupling bolts are purposely removed before shipment. It is of utmost importance that the machine be installed to give the correct alignment at the coupling faces before installing these bolts or attempting to operate the turbine.

The foundation may be either concrete or fabricated steel. In some cases, the turbine and driven apparatus are mounted on a continuous bedplate, and in other cases they are mounted separately on the foundation; if concrete, it is advisable although not absolutely necessary to provide some sort of soleplate beneath the turbine feet. This provides a means of correcting alignment by shims and also makes it possible to remove and replace the turbine without difficulty if such an occasion should arise. In either case, the procedure of installation is the same. The official outline dimension leaflet (copy of which is furnished when the machine is sold and a copy of which is shipped with the machine) shows the space required and the location of the foundation bolts. If the foundation bolts are set in concrete, it is advisable (especially for the larger machines) to place them in pipe sleeves to provide clearance so the bolts can be bent, if necessary, to match the holes in the supporting feet or bedplate. This precautionary measure compensates for any slight shifting of the bolts when pouring the concrete and may save considerable expense and trouble when installing the turbine.

To install on concrete, set the machine in position with the bedplate or supporting feet supported on steel wedges. **Do not depend upon the stiffness of a bedplate to maintain alignment.**

Adjust the wedges to bring the machine as nearly level as possible and place it at the correct height and on the correct centerlines. At this point, be sure that the driven apparatus is in its correct position with relation to pipes or other apparatus to which it connects.

If the driven apparatus is a generator, be sure that the air gap between its rotor and stator is equalized at the top, bottom and both sides. Any inequality in this gap will cause unnecessary friction and heating of the bearings, and unequal heating of the armature iron.

Next, check the alignment by means of the coupling faces and adjust the wedges under the turbine to make this alignment correct. There are several methods of checking the alignment at the coupling. The following is believed to be the most reliable and is given here as a convenient guide.

Coupling Alignment

Aligning For Parallelism of Rotor Axes

This is done by paralleling the faces of the coupling flanges. However, the flange faces may not be perfectly true with respect to the rotor axes. Therefore, the following rules should be followed which compensate for discrepancies in the faces and give accurate results.

Separate the flanges a convenient distance and measure the gap at the top, bottom and both sides. Then rotate both shafts 180° and take another set of readings.

Rule 1 - If the net opening between coupling faces, as indicated by two sets of readings taken 180° apart remains on the same side of the axes, the amounts of the openings should be added and the sum divided by two. The result is the amount that the coupling faces would be open if they were machined perfectly true with the axes.

Rule 2 - If the net opening between coupling faces, as indicated by two sets of readings taken 180° apart, changes from one side of the axes to the other, the amounts of the openings should be subtracted and the difference divided by two. The result is the amount the coupling faces would be open if they were machined perfectly true with the axes.

The following examples explain these rules. (The discrepancies are, of course, greatly exaggerated to add clearness to the examples):

Example I (Refer to Figure 8).

In the 0° position:

Top reading	.024"
Bottom reading..................	.012"
Therefore faces show...........	.012" opening at top.

With both coupling halves turned 180°:

Top reading....................	.036"
Bottom reading..................	.012"
Therefore faces show...........	.024" opening at top.

Since the opening is at the top in both positions Rule 1 applies. Therefore:

$$\frac{.012'' + .024''}{2} = .018''$$

actual opening across the .018" diameter (or .009" across the radius) if the faces were perfectly true.

To put the coupling in correct alignment, raise the outboard end of one shaft so as to bring the faces .009" closer together at the top.

To check the accuracy of this work, take a set of readings in the 0° position and one in the 180° position. If the work is correct, the coupling faces will be open a certain amount at the top in one position and the same amount, but at the bottom, in the other position.

Example II (Refer to Figure 8).

In the 0° position:

Top reading...................... .024"
Bottom reading.................... .030"
Therefore faces show.............. .006" opening at bottom

With both coupling halves turned 180°:

Top reading...................... .054"
Bottom reading.................... .008"
Therefore faces show.............. .046" opening at top

Since the opening changes from bottom to top in the two positions, Rule 2 applies. Therefore:

$$\frac{.046" - .006"}{2} = .020"$$ actual opening across the diameter (or .010" across the radius) if the faces were perfectly true.

To put the coupling in correct alignment, raise the outboard end of one shaft so as to bring the faces .010" closer together at the top.

Of course, these examples show the alignment in the vertical plane only. By applying the same principle to the readings obtained at the two sides, the correct alignment is obtained in the horizontal plane.

Aligning For Concentricity of Rotor Axes

Fasten a "truth" indicator to one half of the coupling, allowing the indicator stem to ride on the other. Roll both halves simultaneously through 360°, taking indicator readings at the top, bottom, and both sides. These indicator readings will show the eccentricity of the two rotor axes. Move one unit so as to make the axes concentric. When making this adjustment, care must be taken to move both ends of the unit the same amount so that the alignment for parallelism, previously completed, will not be disturbed.

Grouting Foundation

When it is assured that the coupling alignment is correct, build a form around the supporting feet (or bedplate if one is used) and pour the grout. The forms should be made of sufficient height and the grout poured to a height at least one-half inch above the bottom of the feet in order to insure a good support. Use a mixture of one part of high grade portland cement and one part of clean sand. Make the grout sufficiently thin to flow and be sure that it fills completely the crevices under the supporting feet.

Allow the grout to become thoroughly set and then tighten the foundation bolts. After the final tightening of these bolts, again check the alignment at the coupling faces. If any change has occurred, make the necessary corrections either by regrouting or by using shims under the turbine feet.

After the final checking of the alignment, dowel the turbine feet to the bedplate or soleplate.

To install on steel work, level and align the unit in the same manner as described above, using shims or flat chocks instead of wedges. Since these shims or chocks form the permanent support, they should be placed adjacent to the foundation bolts and secured to the steel work by screws to prevent them from slipping out. It is important to see that all the shims or chocks fit snugly and that each takes a share of the load when the foundation bolts are tightened finally.

Pipe Connections

Steam Inlet Line

The main steam line should be anchored at the header, receiver or manifold. Always begin at the header and make the connection at the turbine last. The line should be sufficiently flexible so that no undue strains are exerted on the turbine when at operating temperature. This flexibility can be obtained by having the pipe of sufficient length with loops or sections of piping at right angles to each other. It should be properly supported throughout its length with the last support, but not an anchor, located adjacent to the turbine. Spring hangers and rollers are recommended as supports for the larger machines and especially when the weight of the steam line is relatively large compared to that of the turbine.

At the point where the steam line connects to the turbine, make sure that the flange faces are parallel and that no force is necessary to bring them together or to match the bolt holes. In order to reduce to a minimum the force exerted on the turbine by the expansion and contraction of the pipe, the alignment of the flanges should be made with full steam pressure and temperature up to the throttle valve. The final alignment is then made at the joint between the throttle valve and the turbine.

Before finally connecting the steam line to the turbine, it should be blown out thoroughly with high-pressure steam to remove any foreign matter such as dirt, scale, pipe-joint compound, etc., which, if carried into the turbine, might prevent the closing of the governing valves and cause overspeeding, or plug part of the nozzle area, thus reducing the capacity and efficiency of the unit.

It is of utmost importance to install a drain in the steam line at its lowest point between the header and the turbine.

Exhaust Line

The exhaust line should have a flexible-copper expansion joint placed close to the turbine, preferably at the turbine exhaust flange. The exhaust pipe should be anchored just beyond the expansion joint to prevent its weight damaging the expansion joint or the turbine. Even though an expansion joint is used, the same care should be exercised in aligning the pipe flange to the turbine exhaust flange as described for the main steam line. Be sure that the expansion joint is made of material sufficiently light to provide flexibility. Some expansion joints are so stiff that their use is of little value.

Whenever the turbine coupling is to be aligned or the alignment checked, be sure to disconnect the main steam line and the exhaust line in order to eliminate the possibility of these pipes exerting excessive strains on the turbine. When reconnecting them, be sure that the faces can be made parallel and the bolt holes matched without using force.

After the steam and exhaust pipes have been re-connected the unit should be heated up to approximately normal operating temperature and then the bolts should be removed from the pipe connections to check whether or not any excessive springing of the joints takes place. If so, the condition should be corrected before the machine is placed in operation.

Gland Piping, Drains and Steam Leak-offs

The outline drawing shows the various pipe connections with notes indicating the purpose which each serves. These notes should be followed very carefully and, if any are not understood, consult a Westinghouse representative before proceeding with the work.

The openings marked "Steam Leak-Off" include the leak-offs from the rotor shaft glands and from the governing valve and the butterfly or throttle valve stem glands. These must be open to atmospheric pressure at all times and should be connected by piping to a point very close to the turbine, where a small amount of escaping steam is not objectionable.

On machines which exhaust into a vacuum, a supply of low-pressure steam is required to seal the glands. The openings marked "Steam Seal" should be connected to a source of steam supply and throttled to give approximately 2 or 3 lbs. pressure and the steam admitted should be controlled by hand valves so as to maintain just enough pressure to prevent air leakage through the glands.

The openings which are marked "Drain" are the drains from the turbine casing and steam inlet zones which are under pressure. These must be connected by piping with hand valves so they can be opened during the shutdown and starting periods, but closed when the machine is in normal operation. The piping should be led to a point where a steam-blow (during the starting period) is not objectionable.

OPERATION

General

Before starting the turbine, clean off any dirt which may have accumulated during the installation work and be sure that dirt has not gotten into the bearing cavities or other internal parts. Be sure that the working parts of the governing mechanism are clean and in good working condition.

Be sure to place the proper amount of lubricating oil in the bearing oil ring cavities and in the oil reservoir (when a separate reservoir is used). If horizontal centrifugal-weight governor is used, be sure to fill the governor oil cup.

Check the overspeed trip mechanism by means of the hand-tripping device, and be sure it is working properly. Then reset it.

NOTE: This tests only the trip mechanism and does not check the speed at which the overspeed trip weight actually functions.

To Start.

To operate the unit, proceed as follows:

1. Open the drains from the steam inlet and exhaust line, and be sure these lines are free of water.
2. Be sure all casing drains and steam inlet pipe drains are open.
3. Open the exhaust valve.

4. Open the throttle valve sufficiently to start the turbine rolling immediately.

5. Close the hand-controlled drains when it becomes certain that the parts which they drain are free of water and the turbine is heated sufficiently to prevent additional accumulation of water.

6. Open the throttle valve gradually to increase the speed. As the speed approaches normal, see that the governing valves close partly and properly control the speed. This can be seen by movement of the governing valve stems.

7. When the governor has taken control of the speed, open the throttle valve wide.

Test of Overspeed Trip

When the turbine is first started after installation, it is very important to test the overspeed trip by actually overspeeding the machine. When the driven apparatus to which the turbine is connected is such that the load cannot be removed, it may be found difficult (or even impossible) to increase the speed to 10% above normal. In such cases, it is advisable to disconnect the driven apparatus when running the overspeed test.

To overspeed the turbine, proceed as follows: With the turbine operating under control of the governor, increase the speed by gradually pulling the governing valve stem in the opening direction, until the tripping point is reached.

The overspeed trip should operate at approximately 10% above normal full speed. A direct-reading, hand tachometer is preferred for reading the speed, but in case the end of the shaft is not accessible, a vibrating tachometer is satisfactory, provided it has been checked recently for accuracy.

During these tests, the speed should be increased slowly and the tachometer watched very carefully. An operator should stand by, ready to trip the mechanism by hand instantly if it does not trip automatically at about 15% overspeed.

If the mechanism does not trip at the proper speed, it should be inspected and adjusted as described in the supplemental section under the subject of "Overspeed Trip".

This same overspeed test should be made periodically, throughout the life of the machine, to insure that this important safety device is kept in good working condition.

To Shut Down

1. Trip the overspeed trip by hand. This is the easiest way to stop the turbine and will test the trip mechanism. However, this tests only the trip linkage and quick-closing valve and does not check the speed at which the overspeed trip weight functions.

2. Close the throttle valve.

3. Reset the overspeed trip mechanism, thus putting it in the correct position for the next starting period.

4. When the turbine comes to rest, close the exhaust valve and open all drains between the throttle valve and exhaust valve.

Precaution: Keep the exhaust valve closed and all casing drains open while the turbine is shut down. This is of utmost importance to prevent the accumulation of water in the casing which might cause corrosion and impair the future operation.

Care of Turbine

1. Keep the machine clean.
2. Clean the governing valve stem and throttle valve stem as often as necessary to prevent the accumulation of boiler compound or other foreign matter. These parts must be kept working freely.
3. Keep the butterfly valve or throttle valve in good condition and steam-tight, in order to prevent leakage of steam into the turbine during shutdown periods. All drains must be kept open whenever the unit is shut down.
4. Trip the overspeed trip occasionally to see that it is in good working order.

Inspection

About once each year, depending upon the nature of the service, the unit should be dismantled and throughly cleaned and inspected. All parts should be examined for wear. In this way, the cause of excessive wear can frequently be found and corrected before any damage is done. All oil chambers should be cleaned thoroughly to insure removal of all foreign matter and sludge deposits.

Renewal Parts

The accompanying lists have been compiled to facilitate ordering spare or renewal parts. When ordering parts, give the serial number of the turbine and the item number and name of each part desired.

In the event that it becomes necessary to return any part of this equipment to the South Philadelphia Works, it should be tagged with the sender's name and address and the serial number of the unit. Shipments by freight, express or parcel post should be addressed to:

Westinghouse Electric & Manufacturing Company
South Philadelphia Works
Essington, Pa., U.S.A.

PARTS LIST

(All Single-Stage Turbines)

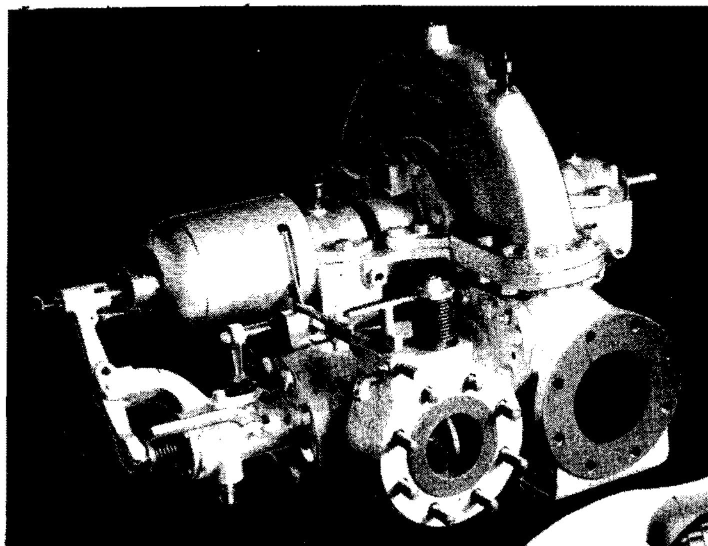
Figures 2, 3, 5 and 6

Item No.	Name of Part	Item No.	Name of Part
1	Steam Chest Body	14	Bearing-Upper Half
2	Nozzle Block	15	Bearing Cover
3	Stationary Blade Holder	16	(Fig. 2 & Fig. 3) Bearing Oil Cup
4	Stationary Blade	16	(Fig. 5 & Fig. 6) Oil Ring Inspection Hole
5	Cylinder Base	17	Oil Thrower Ring
6	Pedestal Stud, or Pin	18	Gland Casing - Lower Half
7	Support Pedestal	19	Gland Casing - Upper Half
8	Bearing Bracket	20	Gland Packing Ring
9	Bearing Oil Ring	21	Gland Packing Ring Spring
10	(Fig. 2 & Fig. 3) Bearing-Lower Half	22	Cylinder Cover
10	(Fig. 5 & Fig. 6) Oil Ring-Lower Half	23	Rotating Blade - First Row
11	(Fig. 2 & Fig. 3) Felt Oil Wiper	24	Rotating Blade - Second Row
11	(Fig. 5 & Fig. 6) Bearing-Lower Half	25	Turbine Rotor
12	Oil Thrower Ring	26	Turbine Rotor Key
13	(Fig. 2 & Fig. 3) Oil Thrower Ring Set Screw	27	Turbine Rotor Shaft
13	(Fig. 5 & Fig. 6) Oil Ring-Upper Half	28	Oil Thrower and Thrust Collar
		29	Thrust Liners
		30	Thrust Ring
		31	Thrust End Bearing - Upper Half
		32	Thrust End Bearing - Lower Half

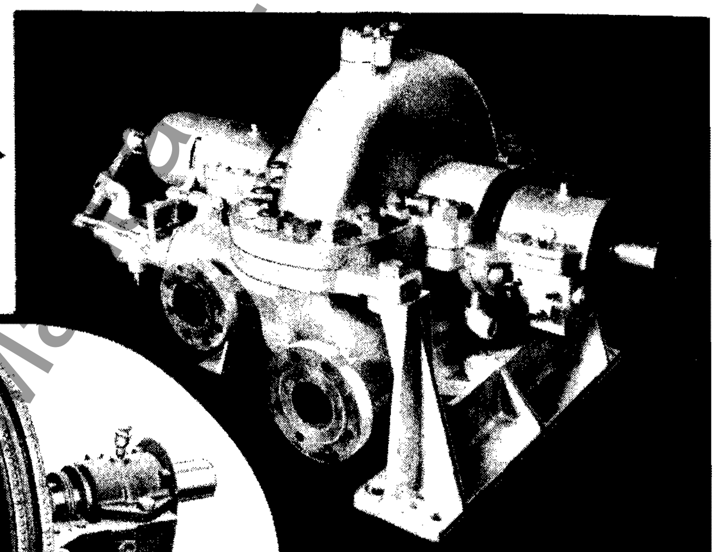
(All Two-Stage Turbines)

Figure 4

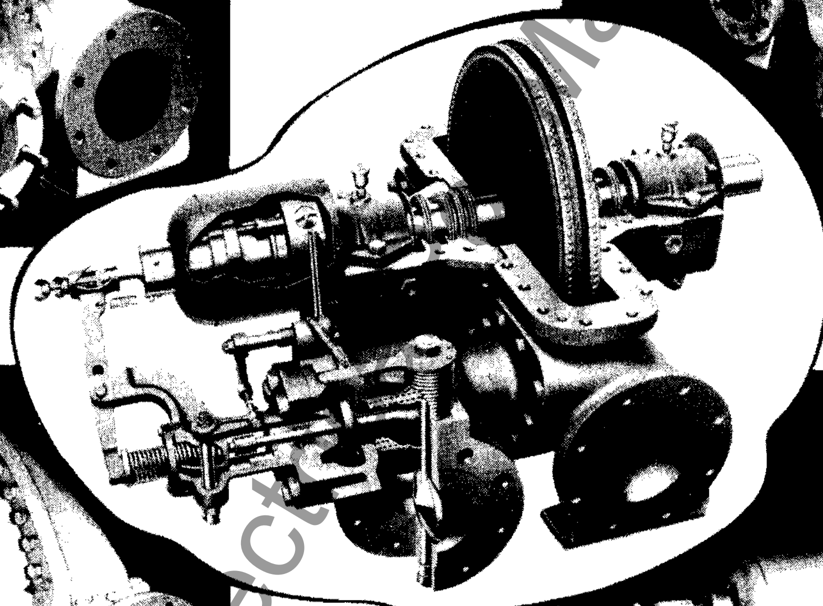
Item No.	Name of Part	Item No.	Name of Part
1	Steam Chest Body	27	Turbine Rotor Key - 2nd Stage
2	Nozzle Block - 1st Stage	28	Turbine Rotor - 2nd Stage
3	Stationary Blade Holder	29	Rotating Blade - 2nd Stage 2nd Row
4	Stationary Blade - 1st Stage	30	Rotating Blade - 2nd Stage, 1st Row
5	Nozzle Diaphragm - Lower Half	31	Stationary Blade Holder 2nd Stage, Cylinder Cover
6	Stationary Blade Holder - 2nd Stage Cylinder Base	32	Nozzle Diaphragm - Upper Half
7	Stationary Blade - 2nd Stage	33	Cylinder Cover - Inlet End
8	Cylinder Base - Inlet End	34	Rotating Blade-1st Stage, 2nd Row
9	Cylinder Base - Exhaust End	35	Rotating Blade - 1st Stage, 1st Row
10	Pedestal Stud	36	Turbine Rotor - 1st Stage
11	Turbine Support Pedestal	37	Interstage Diaphragm Seal Ring Spring
12	Bearing Bracket	38	Interstage Diaphragm Seal Ring Upper Half
13	Bearing Oil Ring	39	Turbine Rotor Key - 1st Stage
14	Felt Oil Ring	40	Interstage Diaphragm Seal - Lower Half
15	Bearing Lower Half	41	Rotor Shaft
16	Oil Thrower Ring	42	Oil Thrower and Thrust Collar
17	Oil Thrower Ring Set Screw	43	Thrust Adjusting Liners
18	Bearing Upper Half	44	Thrust Ring
19	Bearing Bracket Cover	45	Thrust End Bearing-Upper Half
20	Oil Cup	46	Thrust End Bearing Lower Half
21	Oil Thrower Ring		
22	Gland Case - Lower Half		
23	Gland Case - Upper Half		
24	Gland Packing Ring		
25	Gland Packing Ring Spring		
26	Cylinder Cover - Exhaust End		

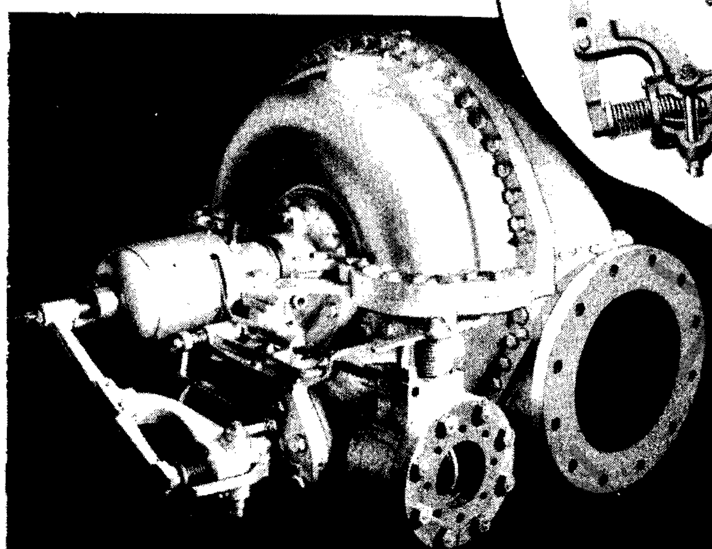


← C-14
C-20



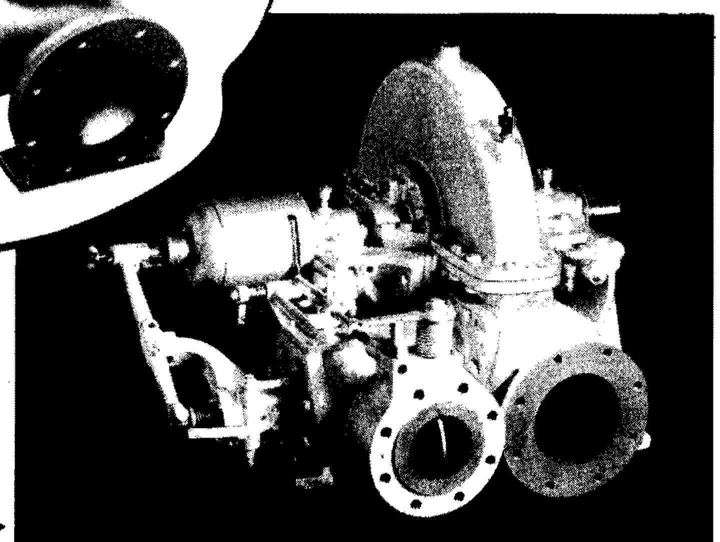
CH-20 →
CH-25





← C-225

Westinghouse
Type C
Steam Turbines



C-25 →

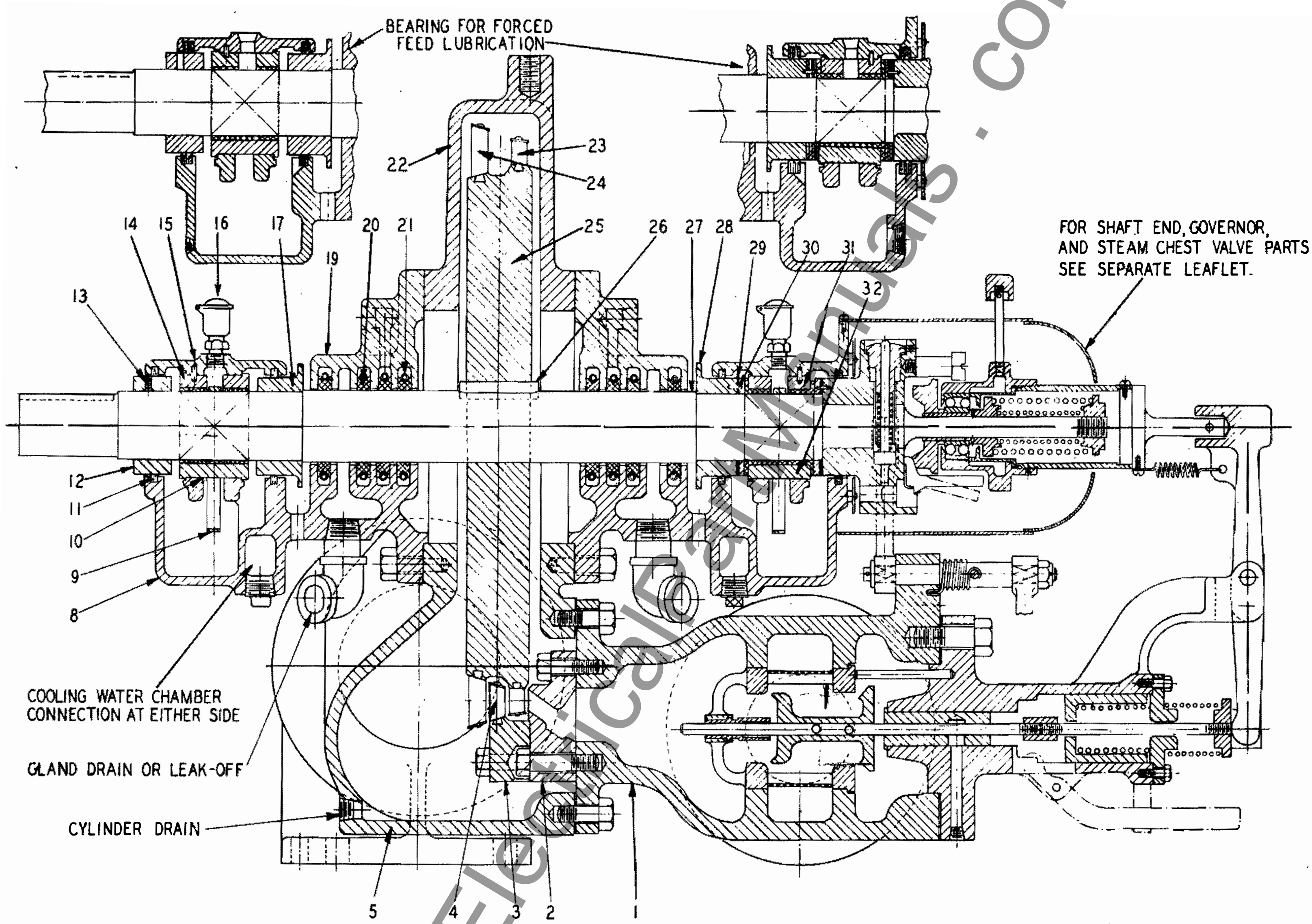


Fig. 2 - Longitudinal Section, Types C-14 and C-20 Turbines

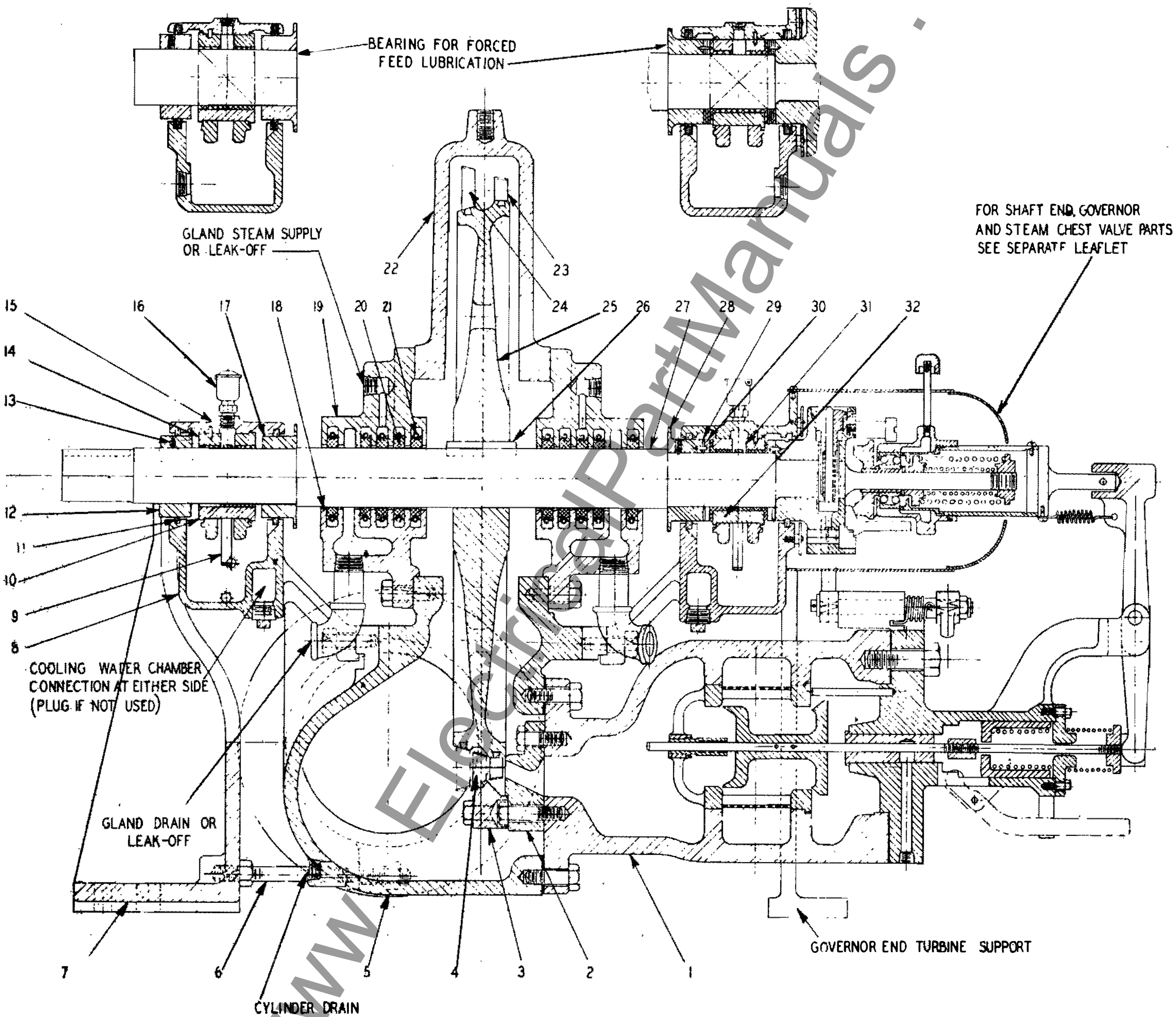


Fig. 3 - Longitudinal Section, Type C-25 Turbine

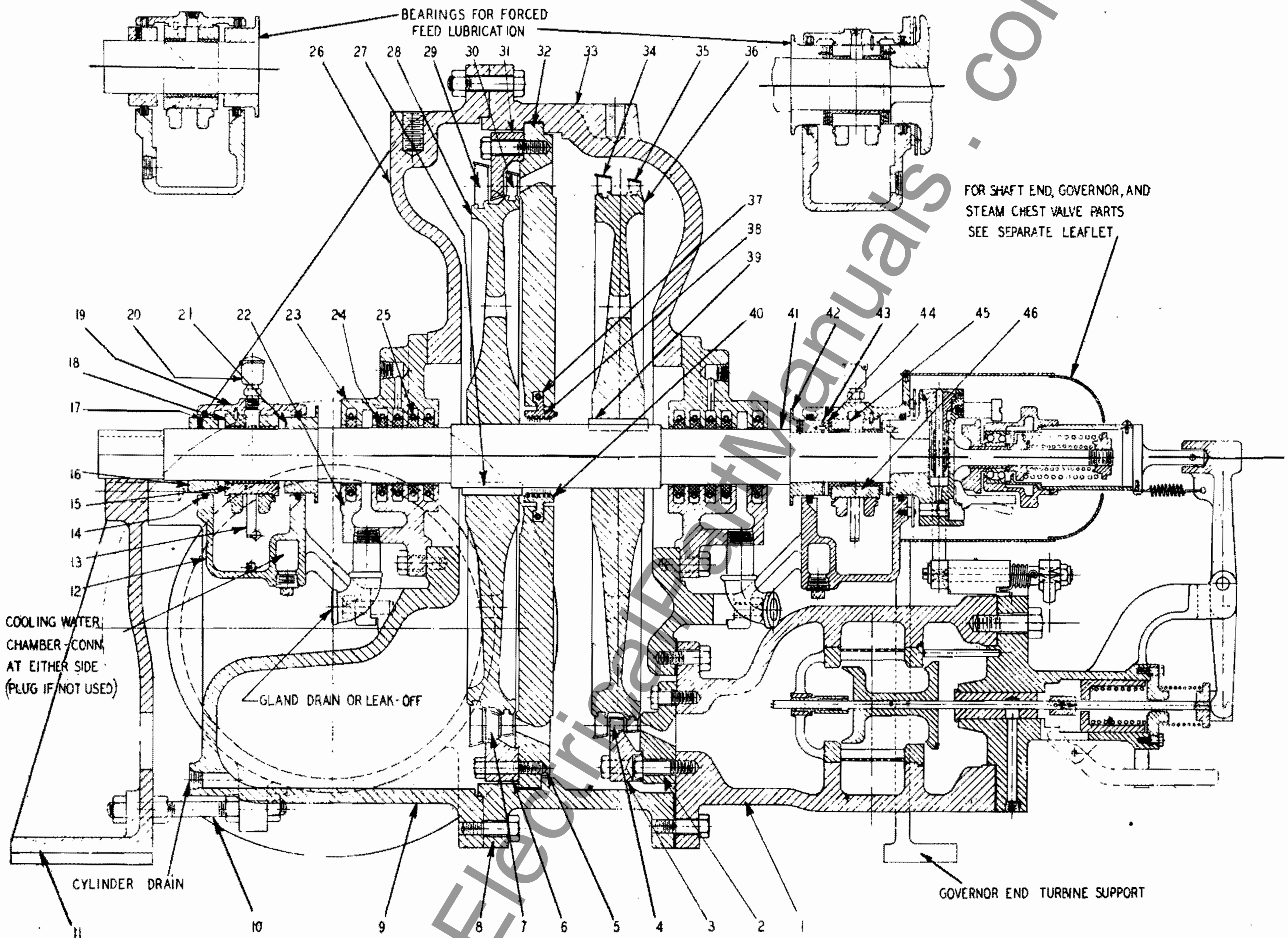


Fig. 4 - Longitudinal Section, Type C-225 Turbine

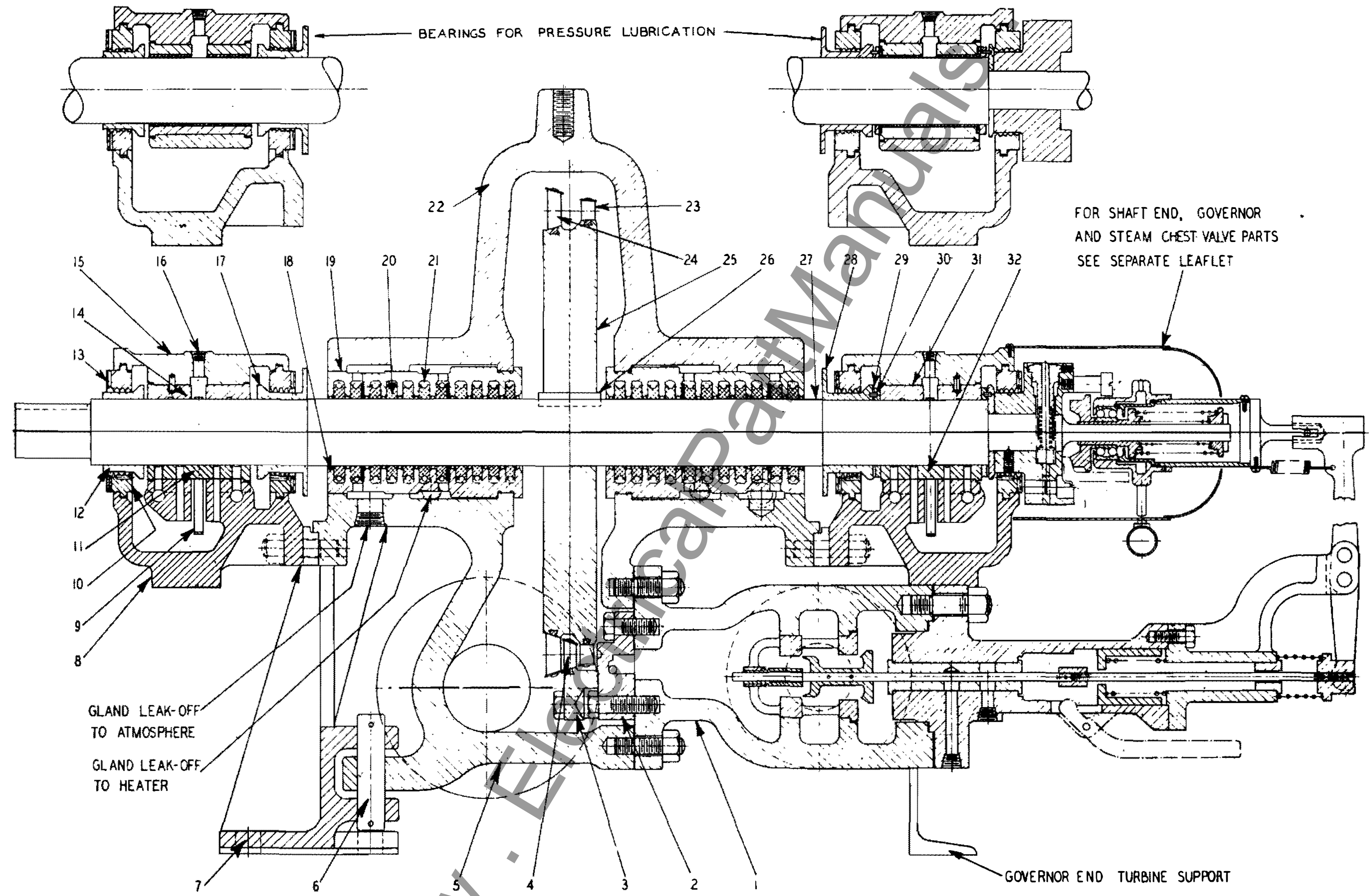


Fig. 5 - Longitudinal Section, Type CH-20 Turbine

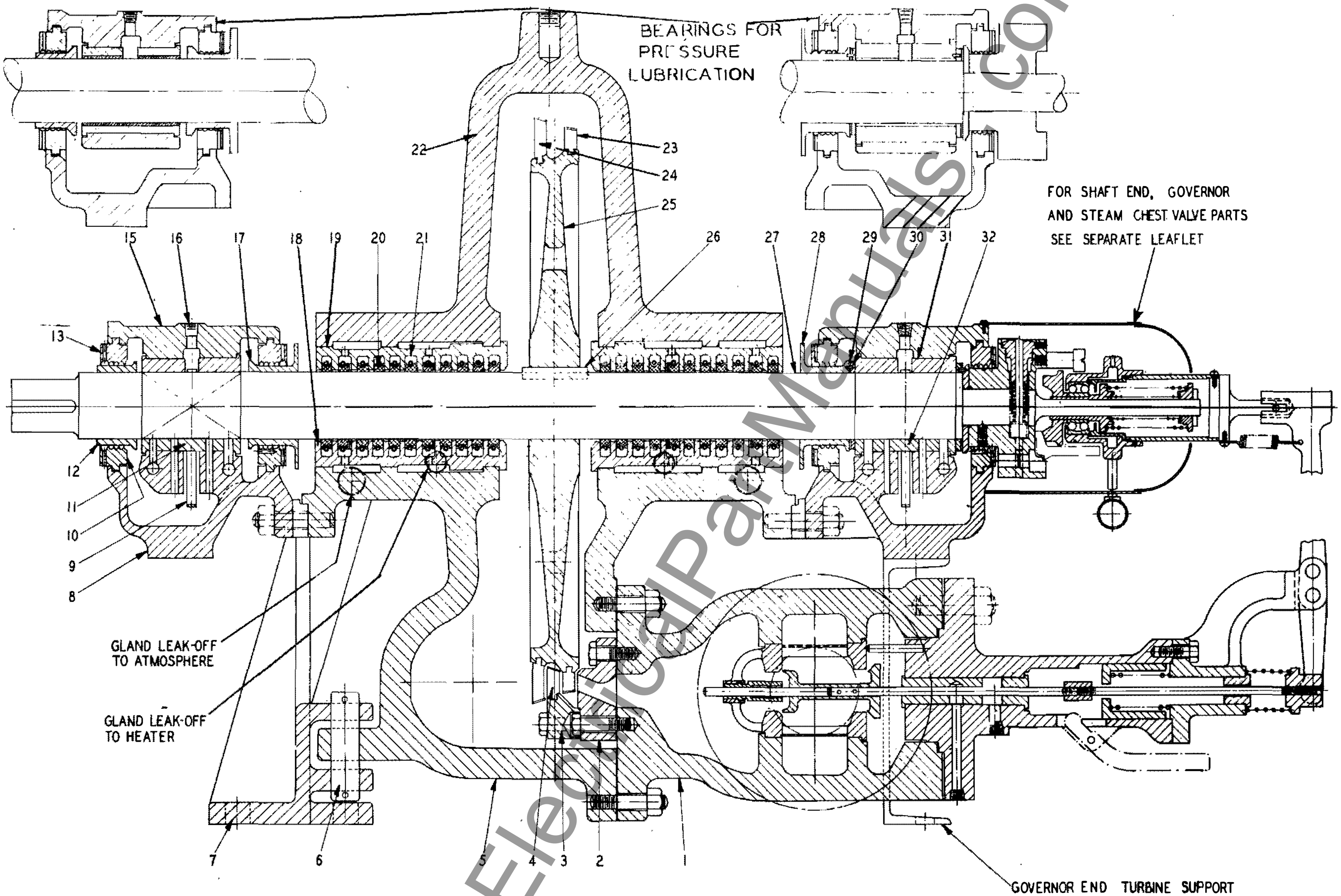


Fig. 6 - Longitudinal Section, Type CH-25 Turbine

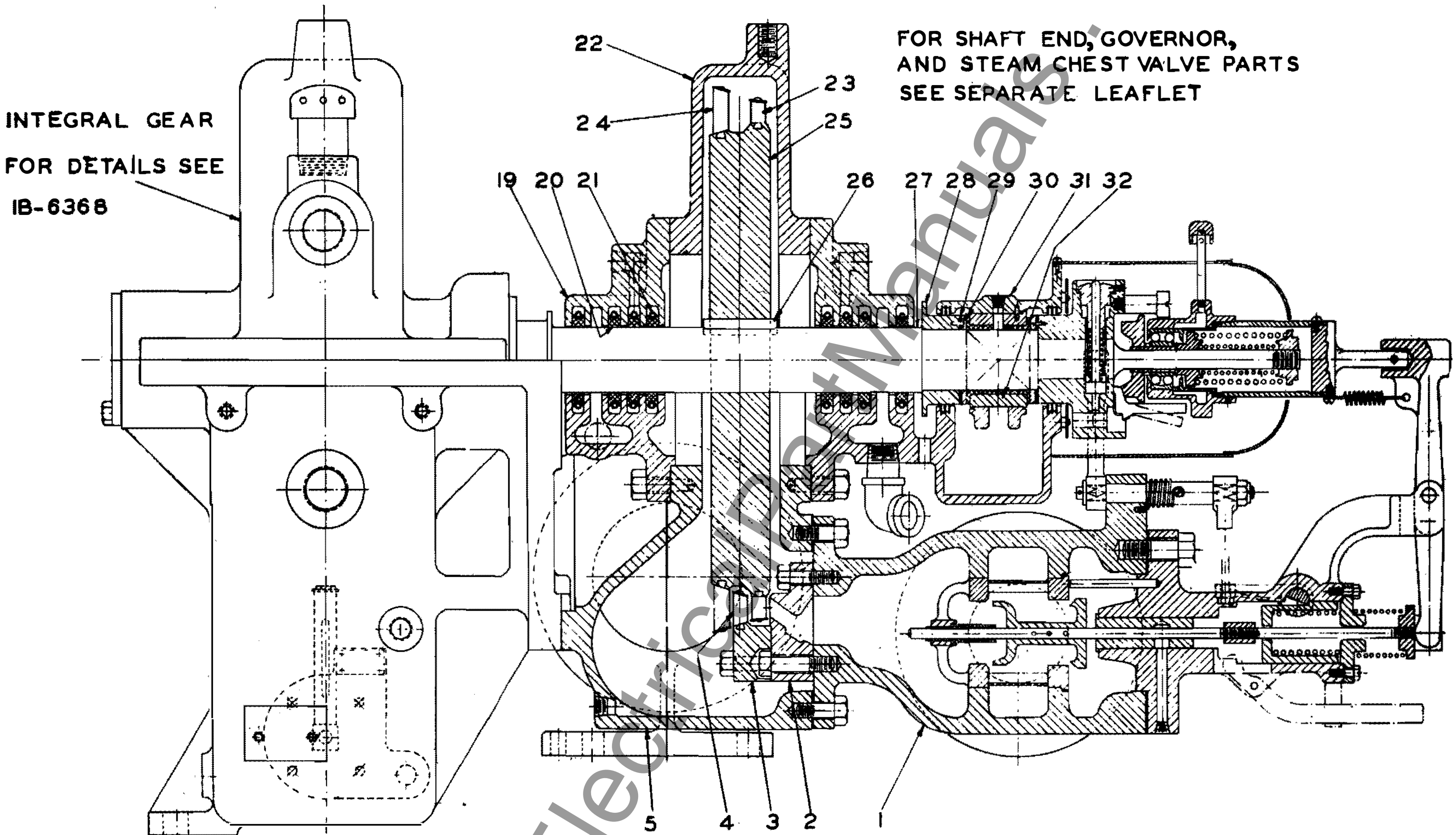


Fig. 7 - Longitudinal Section of Type C Turbine
Connected to Integral Gear

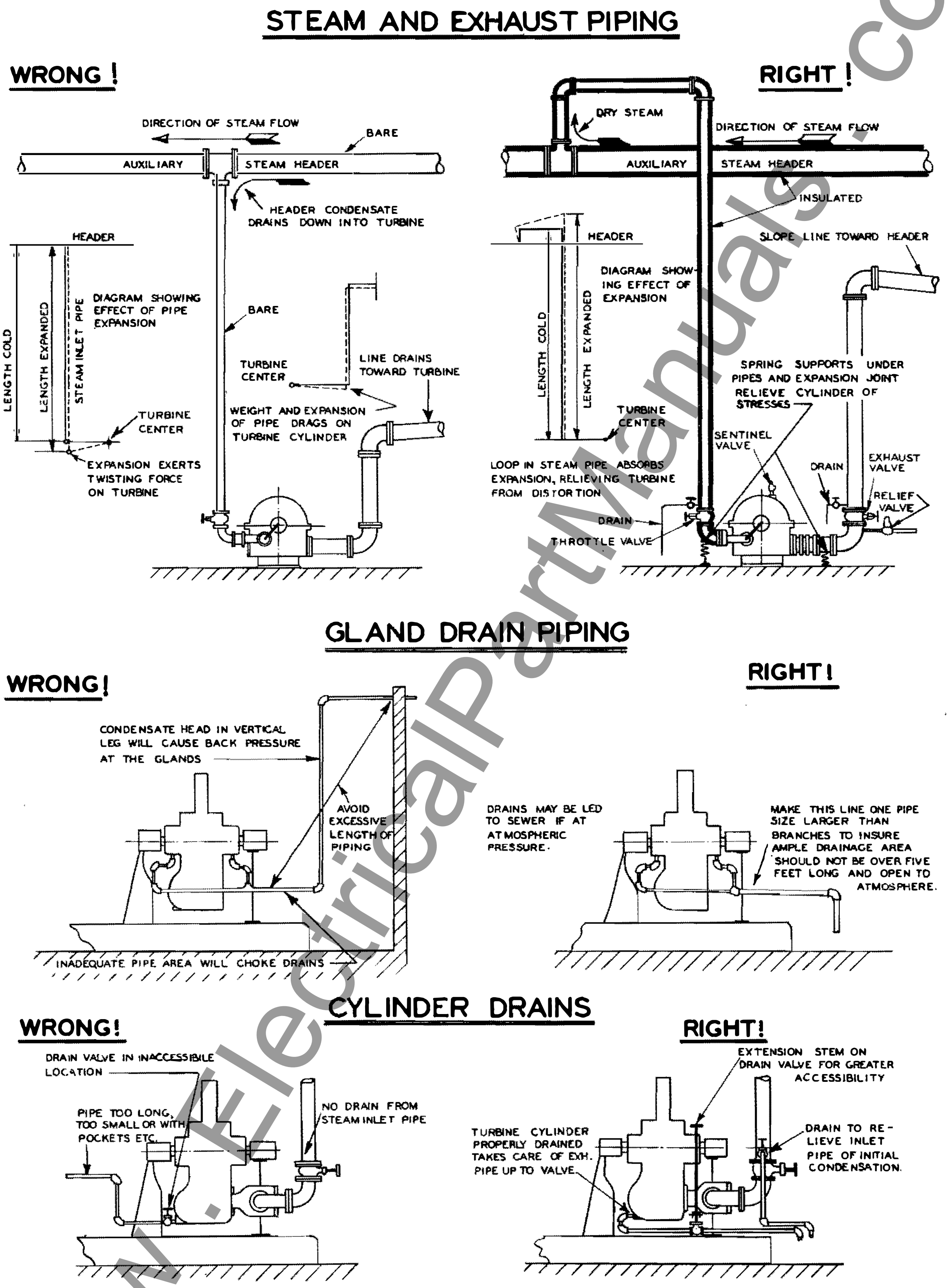


Fig. 8 - Installation "Do's and Don't's"

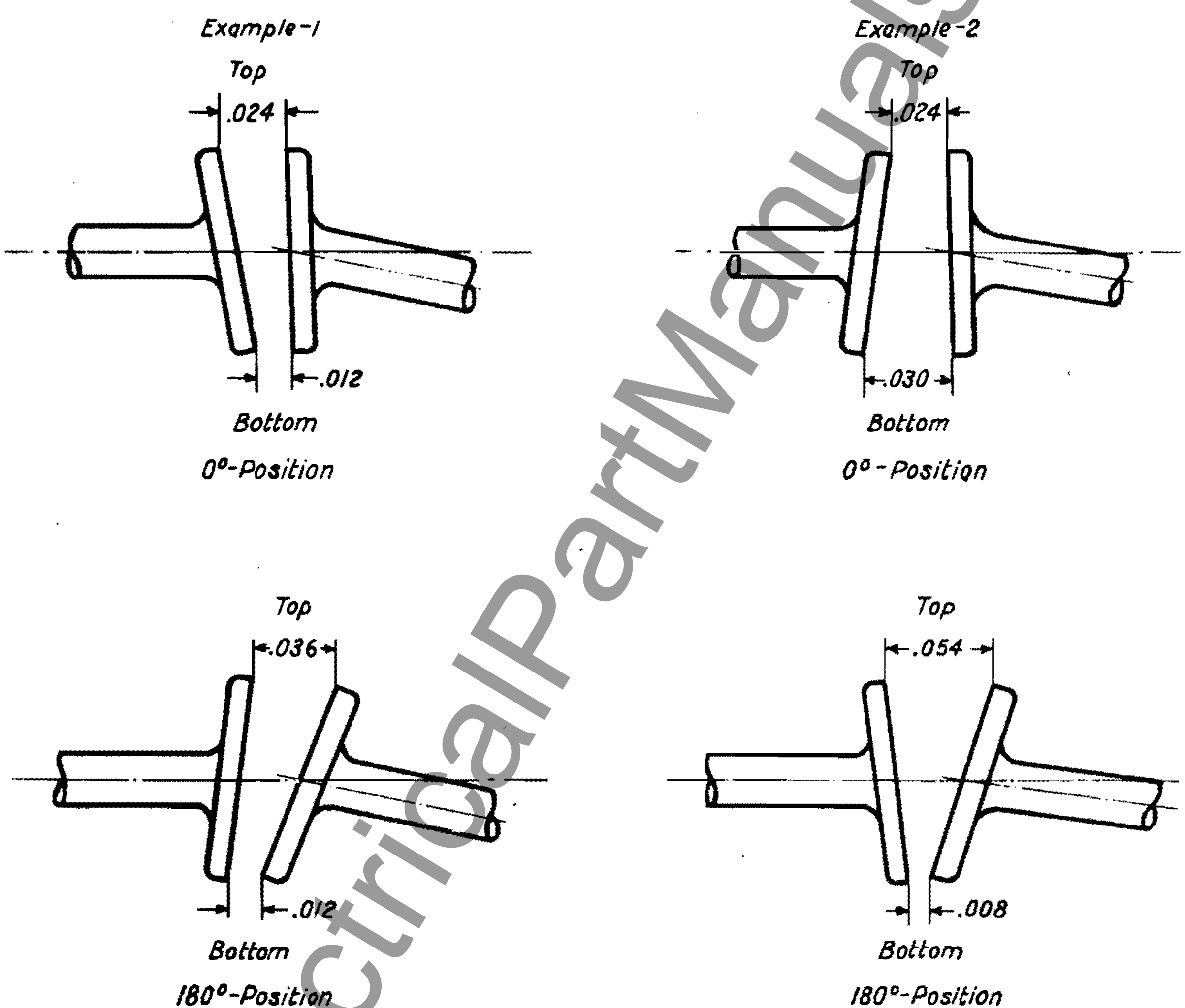


Fig. 9 - Sketch Illustrating Coupling Alignment