DEMAG DELAVAL
TURBOMACHINERY

TECHNICAL MANUAL

TURBINE-DRIVEN CENTRIFUGAL COMPRESSORS

FOR

KOCH NITROGEN COMPANY

STERLINGTON, LA

98873

INSTRUCTION BOOK 1723

DEMAG DELAVAL TURBOMACHINERY SERIAL NOS.

AMMONIA COMPRSSOR UNIT 703428
AIR COMPRESSOR UNIT 679040 / 703429

MARCH,1995
REVISION 1

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GENERAL INFORMATION

EQUIPMENT FURNISHED - The equipment furnished and covered in this part of the manual consists of a De Laval multi-stage, multiple valve steam turbine driving a De Laval multi-stage centrifugal compressor (first body) which is coupled to a De Laval speed increasing gear. The speed increasing gear is coupled to a De Laval multi-stage centrifugal compressor (second body). The entire unit, designed to compress ammonia, is furnished with lubrication and seal oil systems described later in this manual. Additional accessories, necessary for safe and efficient operation of the compressor unit, are also furnished.

GENERAL DESCRIPTION - The ammonia compressor unit is arranged as shown on the Unit Outline Drawing in the Last section, Part 1, of this manual. The multiple valve steam turbine drives the first body compressor. This compressor has four stages. The compressed gas, after discharging from the fourth stage, is led to the second body compressor.

The first body compressor shaft, turning at the same speed as the turbine, is coupled to a De Laval Type HG special speed increasing gear. The speed increasing gear is coupled to the second body compressor shaft and the required speed for this compressor is obtained.

The second body compressor has seven stages with suction and discharge points arranged as shown on the outline drawing.

DESIGN DATA

Turbine - 105JT

Manufacturer	De Laval
Model Designation	KJDFMV
Rating, BHP	
Normal	11,255
Design	11,810
Rated	12,401
Speed, RPM	
Normal	6,640
Design	6,700
Rated (Max. Cont.)	7,035
Critical	4,100
Rotation (Facing Governor end of Turbine)	CCW
Inlet Pressure, psig	
Rated	545

Maximum	600
Inlet Temp., °F	
Rated	610
Maximum	750
Exhaust Press., in. Hg. A	4.0
Tripping Speed, RPM	7,739
Oil Press. to Turb. Governor psig	140
Oil Press. to Turb. Bearings, psig	15-20
Casing Relief Valve Setting, psig (Max.)	5

Pneumatic Reset

Manufacturer	Conoflow Corp.
Type	B-51XL
Stem Action	
Extended	3 psig Signal Air Press.
Retracted	15 psig Signal Air Press.
Signal Air Pressures	
@ Min. Turbine Speed, 5700 RPM	15 psig
@ Max. Turbine Speed, 7035 RPM	3 psig

Positioner

Manufacturer	Bailey Meter Co.
Type	P99-5
Cam Installed	"B-1/2"
Alternate Cam	"B"

First Body Compressor 105 JBC LP comp

Manufacturer	De Laval
Model Designation	4C30/20
Design, BHP	2,208
Speed, RPM	3/65 5981 ~~6,700~~ 6280
Rotation (Facing Governor end of Turbine)	Counter-Clockwise
Gas Handled	Ammonia
Specific Gravity	0.587
C_p/C_v	1.31
Z	.977
Suction Pressure, psia	14.7
Suction Temp., °F	-28
Discharge Press., psia	47.5
Capacity, CFM	18,560

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Second Body Compressor 105 JAC HP comp

Manufacturer	De Laval
Model Designation	$7CK_1$ 20/14

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Second Body Compressor (Cont'd)

Rating, BHP	9,422
Speed, RPM	8,900
Rotation (Facing Governor end of Turbine)	Clockwise
Gas Handled	Ammonia
Specific Gravity	0.587
C_p/C_v	1.30
Z	0.970
Suction Press., psia	46
Suction Temp., °F	85
Discharge Press., psia	263.7
Capacity, CFM	14,670

Speed Increasing Gear

Manufacturer	De Laval
Frame	HG-Special
Horsepower	11,010
Input Speed, RPM	6,700
Output Speed, RPM	8,900
Ratio	1.328 to 1
Inlet Oil Temp., °F	110-120
Inlet Oil Press., psig	10-15
Losses, BHP	176

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COMPRESSOR INFORMATION

GENERAL - The centrifugal compressors furnished for the ammonia compressor service are both multi-stage machines. The first body compressor is a Model 4C30/20 having four stages, a 30-inch suction inlet and an 20-inch discharge. This compressor is coupled to the turbine driver. The other end of the compressor shaft is coupled to a speed increasing gear which in turn drives the second compressor (or second body). The second body compressor is a Model $7CK_1$, having seven stages, a 20-inch diameter suction inlet and a 14-inch discharge. The second body compressor is fitted with intercoolers as described later in this section.

FIRST BODY COMPRESSOR (See Assembly Dwg.) - The design features of the De Laval centrifugal multi-stage first body compressor can be seen on the compressor assembly drawing and on the thrust bearing sub-assembly drawing. A centrifugal compressor operates in the same manner as a centrifugal pump, except that it handles a compressible gas. The wheels or impellers impart velocity energy to the gas being compressed. This velocity energy is then converted into increased pressure in the diffusing portions of the internal gas passages.

Casing - The compressor casing consists of two parts, the case and case cover, fastened together at a flat joint in a horizontal plane through the centerline of the shaft. The casing serves to contain and support, directly or indirectly, all other parts of the compressor. The compressor inlet and discharge connections are located as shown on the compressor assembly drawing and on the unit outline drawing. Note that one suction inlet leads to the first stage, with the discharge connection leading from the fourth stage. The case cover may be removed for repairs without disturbing the case.

Rotor- The rotor consists essentially of a number of wheels mounted on the compressor shaft. The individual wheels may be closed cast wheels, or open cast wheels. The wheels are shrunk and keyed on the forged compressor shaft. Spacers are shrink fitted between the wheels and a balance drum is shrunk and keyed on at the discharge end of the compressor shaft. A checknut secures the assembly. The thrust bearing collar is secured to the shaft by checknuts. Each wheel, the balance drum and the complete rotor are dynamically balanced.

Axial Balancing Arrangement - The pressure differences acting on each wheel produce an axial force toward its inlet. The sum of the individual wheel forces, or the total axial force, is counteracted by the pressure difference, discharge pressure less suction pressure, acting on the balance drum.

Bearing Brackets - The bearing brackets serve to support and position the main bearing housings, the thrust bearing and the compressor shaft seals. The bearing brackets are bolted to and piloted in the case and have two dowels in the bottom half.

Main Bearings - The two main bearings (See Dwg. IBD-6403) are babbitt-lined, multiple tilting pad type bearings. The pads of each bearing are fitted into a one-piece bearing housing and are secured by special screws. The bearing housing is prevented from rotating by a pin projecting from the bearing housing into a slot in the bearing cap. The weight of the rotor is supported by the bearing pads, with the babbitt-lined bearing bushing acting as a pressure breakdown device for the high pressure seal oil in the seal chamber. The bearing bushing is fitted into the bearing housing and secured with two lock screws.

The main bearings are lubricated by the seal oil which passes through the floating bearing bushing. This oil then passes out through the individual bearing oil drain lines.

Thrust Bearing (See Dwg. IBD-6404) - The rotor is positioned by the thrust bearing which also serves to absorb any axial imbalance. This bearing is a Kingsbury, double acting thrust bearing of the multiple-shoe, self-aligning and equalizing type. The thrust bearing is mounted next to a main bearing in a bearing housing formed by a bearing bracket and by its bearing bracket cap.

The thrust element consists of a steel rotating member called the thrust collar; two sets of stationary, pivoted, babbitt-faced segments called thrust shoes; and a load equalizing mounting for each set of shoes consisting of upper and lower leveling plates. The thrust collar is keyed to the shaft and held against a locating shoulder by two checknuts and a handfitted split ring. The checknuts are locked to the shaft by setscrews. Each set of thrust shoes with their leveling plates are pinned to a base ring which is keyed to a thrust bearing ring. The two thrust bearing rings are prevented from rotating by pins and are positioned axially by vertically split shims.

The thrust shoes and leveling plates are designed and mounted so that the shoes automatically tilt in any direction and assume the positions best suited for oil film, load, speed and viscosity requirements. This design also permits the bearing to adjust to any misalignment, thereby assuring even load distribution among all thrust shoes under any condition.

Pressure lubrication is employed. Oil piped from the lubrication system flows to the thrust bearing through passages formed in the bearing bracket.

The oil is admitted to the lower half of the bearing in two places, one on each side of the thrust collar. The thrust bearing oil guards minimize oil leakage along the shaft. The oil passes out through two drain holes at the top of the bearing and out through an individual bearing drain. The oil that leaks past

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the oil guards along the shaft flows out through the drain line provided for the adjacent main bearing.

Diaphragms - The diaphragms serve to partition the casing and to form the gas passages which with a wheel make up a compressor stage. The diaphragm rims are machined to fit into grooves in the compressor casing. The diaphragms are split horizontally, and the upper halves are secured to the case cover by screws. Tapped holes in the diaphragm joint faces facilitate handling the diaphragm halves. Diffusers, bolted to the case, and diaphragm rings fastened to the diaphragms (if fitted) also serve to form the gas passages.

Inlet Guide Vanes - The inlet guide vanes serve to provide the proper inlet flow conditions at each wheel. The inlet guide vanes are machined to fit into grooves in the diaphragms. The inlet guide vanes are split horizontally, and the upper halves are secured to the upper diaphragm halves by screws.

Case Rings - Labyrinth type case rings serve to reduce leakage from the discharge to the inlet of the closed type wheels. These case rings are machined to fit into "L" shaped grooves in the inlet guide vanes. The case rings are split horizontally and are prevented from rotating by pins.

The contoured type case rings serve to reduce leakage from the discharge to the inlet of the open type wheels. These horizontally split case rings are fitted into grooves in the diaphragms. They are positioned axially by two horizontally split shims. The upper case ring half is secured to the upper diaphragm half by screws.

Diaphragm Bushings - The labyrinth type diaphragm bushings serve to reduce leakage between stages. The diaphragm bushings are machined to fit into "L" shaped grooves in the inlet guide vanes. The diaphragm bushings are split and are prevented from rotating by pins.

Balance Drum Labyrinth - The babbitt-lined balance drum ring forms a labyrinth with the toothed balance drum to reduce leakage past the balance drum. The horizontally split ring is fitted into a groove in the casing. The upper ring half is secured to the casing cover by screws.

Shaft Labyrinths - The labyrinth type tightening rings serve to reduce leakage at both ends of the compressor shaft into or out of the compressor casing. The tightening rings are machined to fit into grooves in the bearing brackets. The tightening rings are split horizontally and the two halves are bolted and doweled together. The tightening rings are prevented from rotating by pins.

Buffer gas is supplied to the center of each ring to ensure that no oil enters the case. The buffer gas is supplied from the gas discharge nozzle as shown on the Unit Oil and Control Diagram.

Oil Guards - The labyrinth type shaft oil guards serve to prevent leakage of oil from the bearings along the shaft. The horizontally split oil guards are fitted into grooves in the lower bearing brackets and in the bearing bracket caps. The oil guards are prevented from rotating by pins.

Intercoolers - The gas exhausting from the first body compressor is passed through an intercooler before it is reintroduced to the second body compressor. The cooler (furnished by others) is designed to cool the gas from approximately 205°F to approximately 110°F.

Couplings - The compressor shaft is connected to the turbine output shaft by an Amerigear No. 104 Class I special spacer type coupling. The other end the compressor shaft is connected to the speed increasing gear by an Amerigear No. 103 1/2 Class I special lightweight flanged type coupling. The speed increasing gear is connected to the second body compressor by an Amerigear No. 103 Class I special spacer type coupling. Manufacturer's information on these couplings is contained in Section 8. The couplings (except for the gear shaft hubs) are designed to be installed and removed by use of a hydraulic coupling mounting tool. Use of this tool is contained in Section 8.

Shaft Seals (See IBD-6403) - Seal oil pressure is used to prevent any leakage of the gas being compressed along the shaft at each end of the compressor. Seal oil is pumped into the seal chambers in the case and the bearing brackets where the pressure is regulated to be greater by a constant differential than the gas pressure being sealed. A contact type seal in each seal chamber allows only a slight oil leakage (necessary for seal lubrication) inwards along the shaft. This leakage is collected by the seal oil drain system.

The contact type seal consists of a rotating reversible seal collar secured to the compressor shaft by drive pins and a checknut, a floating carbon seal ring, a nose piece, a guard, a seal ring pin, seal ring springs and the necessary sealing "O" rings. As the seal ring is hydraulically balanced, the loading between the seal ring and the seal collar is determined by the seal ring springs. Although the seal ring is prevented from rotating by the seal ring pin it is free floating to follow any axial movement of the seal collar. The labyrinth ring in the case prevents any oil from leaking along the compressor shaft into the compressor.

SECOND BODY COMPRESSOR (See Assembly Dwg.)- The design features of the De Laval centrifugal multi-stage second body compressor can be seen on the Compressor Assembly drawing and on the thrust bearing sub-assembly drawing.

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The second body compressor is similar in construction to the first body compressor except for the arrangement and size of the suction and discharge piping, number of stages, size of compressor wheels, and shaft dimensions.

The description of the components comprising the first body compressor applies generally to the components of the second body compressor.

SECTION 7 - OPERATION

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M. W. Kellogg - All Units

IMPORTANT NOTICE

ALL ARMSTRONG DRAINERS FURNISHED WITH THIS UNIT ARE SHIPPED WITH THE FLOATS PACKAGED SEPARATELY. DO NOT ATTEMPT TO START THE UNIT BEFORE THE FLOATS ARE INSTALLED IN THE DRAINERS.

SPECIAL INSTRUCTIONS FOR SEAL SYSTEM OPERATION

1. Assure that seals and the sealing system are clean and mechanically operative.

2. Prime loop seals with oil.

3. With the buffer gas system, maintain seal gas pressure at 1 to 3 psi higher than compressor suction pressure. Buffer gas valves (See Page O-1 (S)) have orifices drilled in their gates. They may be adjusted as necessary to maintain the positive buffer gas pressure at 1 to 3 higher than compressor suction pressure.

4. Check to make sure that drains from Peerless separators back to seal drain line (loops) have been revised such that drains come directly from bottom of separators.

5. Make sure that all buffer gas return lines are orificed. L. P. unit should have 7/16" orifices on both suction and discharge buffer gas return. H. P. unit should have 5/16" orifices on both suction and discharge buffer gas returns.

OPERATION

To assure successful operation of this equipment, review instructions on all systems and components until thoroughly understood. The outline below should be integrated with existing plant operational procedures.

INITIAL STARTING PREPARATIONS - Before the equipment is started for the first time, after a lengthy shut-down, or after the equipment has been taken apart for inspection or repairs, clean the unit as described in Section 6, "Cleaning and Flushing."

NORMAL STARTING PREPARATIONS

1. Drain condensate from steam lines, turbine case, and steam valves and throttle valve by opening their respective drain valves. Close drain valves after condensate stops flowing.

2. Check oil level in reservoir at full mark. The oil used should conform to the specifications in the Lubrication Recommendations Form in Section 5. Recovered flushing oil should not be reused without the approval of the lubricant supplier. Be sure the oil is in good condition, uncontaminated by water, sludge or other foreign matter.

3. Grease trip throttle valve, servomotor and nozzle valve operating gear. Use a high grade, high temperature, high drop point ball bearing grease.

4. Open stop valves in the main and auxiliary oil pump discharge lines.

5. Open stop valves and close by-pass valves on the pressure regulating and reducing valves.

6. Open the compressor kick-back (recirculating by-pass) valves.

7. Open stop valves in oil and gas lines to differential pressure regulators and differential pressure transmitters.

8. Open stop valves in oil and gas lines to seal oil drainers.

9. Be sure stop valves to gages, level indicators, alarms and trips are open.

10. Open stop valves which admit 50 psig instrument and control air to compressor seal system elements (Differential Pressure Transmitter and Differential Pressure Control Valve).

11. If necessary, turn on steam to heater under reservoir and raise oil temperature to at least 60 F.

12. Start the turbine-driven main oil pump. Once normal oil pressures are obtained, place the motor-driven auxiliary oil pump starter in the automatic position.

13. Stop the turbine-driven main oil pump. Check to see that the auxiliary oil pump comes on automatically at the correct pressure. If it does, restart the turbine-driven main oil pump. Stop the motor-driven auxiliary oil pump and place its starter in the automatic position.

14. Open the oil cooler and filter discharge by-pass line valves.

15. Open the oil cooler and filter vents until oil appears. Close the vents and the by-pass line valves.

16. Check oil pressures. Pump discharge control oil pressure should be 140 psig. Turbine bearing oil pressure should be 15 to 20 psig. Seal oil differential pressure will be 40 to 50 psi. Make sure there is a normal flow of oil through all oil flow indicators on the compressors and on the turbine.

17. Open stop valves in air supply lines to the speed governor air reset.

18. Position stop valves for turbine and compressor lines in accordance with station operational procedures in preparation for warming up the equipment.

19. Check emergency stopping system. Make sure system operates when either the remote emergency shut-down pushbutton is pushed or the trip lever is turned to the trip position.

20. Admit steam to gland seal ejector and start cooling water flowing through gland condenser.

21. Open trip throttle valve sufficiently to bring turbine up to a speed of about 500 rpm so that turbine may be heated evenly.

CAUTION

To prevent rotor distortion, make sure rotor is rotating whenever steam is flowing into the turbine.

22. Adjust the steam seal system supply and dump valves to maintain 1-1/2 -2 psig sealing steam pressure. Adjust steam supply to ejector so that 10 to 16 in. of water vacuum is maintained in the gland condenser.

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23. Operate at 500 rpm for not less than a half hour. During the warming period listen carefully for any rubbing, unusual noise or vibration. If any rubbing is detected, decrease speed until all evidence of rubbing has disappeared. If the noise continues, shut down immediately. Do not resume operation until the cause of the trouble has been determined and corrected. Also during the warming period, check oil pressures, oil temperatures, oil flow to bearings and general mechanical performance of the unit. Crack turbine drains occasionally to allow any condensate which may collect in the turbine case to blow off.

24. After the turbine has been thoroughly warmed, and the temperature of the oil has reached at least 90 F, gradually increase the speed of the unit by opening the trip throttle valve slowly but steadily until the governor comes into play.

25. Admit cooling water to the gas coolers.

26. After the governor has assumed control open the trip throttle valve wide.

27. Operate on the governor until it has been definitely established that the mechanical performance of the unit is satisfactory and that the proper operating conditions are being maintained.

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PLACING UNIT ON THE LINE

1. Position compressor and turbine stop valves for bringing unit on the line by throttling the kick back valves.

2. Place the governor air reset in the manual position and increase the speed of the equipment under the control of the speed governor to get the process at the minimum flow rate.

3. Observe operation to be sure the equipment is carrying the load. Put the pneumatic positioner in the automatic position to control the equipment.

4. Readjust steam inlet to ejector to maintain 10 to 16 in. water vacuum on the gland condenser.

5. Readjust the steam seal system supply and dump valves to maintain 1-1/2 to 2 psig sealing steam pressure.

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RUNNING - Once the equipment is in operation the following periodic log checks should be made of the unit speed, pressures, temperatures, and general operating efficiency. Condition of oil should also be checked periodically. Exposed control linkages, trip throttle valve, servomotor and steam ad-

mission valve operating gear should also be lubricated periodically. The equipment should be watched closely for oil leaks, vibration, rubbing or other unusual noises or any abnormal operating conditions.

REMOVING FROM LINE

1. Place the governor air reset in manual position and begin decreasing speed to remove the unit from the process.

2. When unit has been removed from the process, decrease speed as low as possible with the air reset. Open the kick back valves and trip the throttle valve with either the remote emergency shut-down switch or with the trip lever to shut down the unit.

3. Close stop valve in the main steam line.

4. When equipment comes to rest, turn off steam supply to ejector, water to gland condenser, and steam to the steam seal system.

5. Close stop valves in air supply line to speed governor positioner and compressor seal elements.

6. Shut down the gas coolers.

7. Open drains in steam line and turbine case.

8. Circulate oil through the equipment until the oil temperature drops to 100F.

9. Stop the turbine-driven main oil pump and check to see that the motor-driven auxiliary oil pump comes on automatically. Secure both pumps and close all steam, gas and oil valves as dictated by plant procedure.

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OPERATION OF AMMONIA COMPRESSORS ON AIR

GENERAL - After installation, and before initial operation of the ammonia compressor unit, it may be necessary to operate the compressors using air as the compressed gas. The procedures discussed in the following paragraphs should be followed as closely as possible should operation on air prove necessary.

BOTH COMPRESSOR BODIES - As a result of the low pressure at the suction and discharge ends of the compressor, it is necessary to revise the buffer gas system. Air from an external source at 60-70 psig should be introduced into the buffer gas system at the blanked flange opening provided. It is essential to control the quantity of buffer air such that some air always flows outward as well as inward from the labyrinths. The orifice valves (Item 243A and 243B of Unit Oil and Control Diagram) may be opened to permit additional air to enter the buffer gas systems. It is also necessary to blank the buffer gas connection at the discharge nozzle to prevent the external air supply from entering the case.

It should be emphasized that discharge temperature should be the controlling factor in air operation of the ammonia units. This temperature must be limited to 350^{O}F by speed reduction if necessary. This limitation is established by oil and O-ring requirements.

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MAINTENANCE

GENERAL CARE - The external surfaces of the compressor should be kept clean at all times. To maintain efficient operation and to guard against the development of any condition which might lead to a breakdown, a general inspection and overhaul of the compressor should be made ten to twelve months from the initial starting. This inspection and overhaul should normally be repeated thereafter at intervals of not more than 10,000 operating hours or fifteen months, whichever period expires first. The interval between inspections should never exceed two years. Local conditions will, of course, determine the frequency with which the compressor should be opened for cleaning.

When the unit is not in service, every precaution should be taken against corrosion. Oil should be pumped through the compressor for a few minutes every day, and while this is being done, the compressor should be turned over if practicable so that the bearing journals will be properly oiled and the rotor will come to rest in a new position. Every possible measure should be taken to prevent the accumulation of moisture in the casing.

INSPECTION AND OVERHAUL - The compressor should be completely disassembled for this purpose and diaphragms, inlet guide vanes, case rings, diaphragm bushings, labyrinths, tightening rings, oil guards, bearings, the entire rotor and any accessories should be examined carefully for wear or deterioration of any description. Such adjustments and repairs as may be found necessary or advisable should be made at this time.

COMPRESSOR DISASSEMBLY - When performing any maintenance on the compressor, and particularly when disassembling the compressor, the following precautions should be observed.

1. Always study the instruction book and pertinent drawings before commencing work on the compressor.

2. All exterior parts and covers should be thoroughly cleaned before they are lifted.

3. Blank off all openings to prevent the entrance of foreign matter.

4. It is good practice to note or mark the parts as they are removed so that they can be reassembled in their original positions. This is particularly important when disassembling the thrust bearing and all labyrinth-type packings.

5. Parts that are removed should be protected and kept clean.

6. Take great care to prevent injury to any of the labyrinth-type packings.

7. It is strongly recommended that the services of a DE LAVAL field engineer be obtained to insure the proper handling of a major disassembly. The expert knowledge and skill of a factory trained man will provide the best possible insurance that the job will be handled properly and that the time and expense involved will be kept down to a minimum. Should the compressor rotor require dismantling, it must be returned to the factory.

WARNING

THE COMPRESSOR CASE MUST BE COMPLETELY DEPRESSUREIZED BEFORE DISASSEMBLY BEGINS.

The following principal steps should be observed when disassembling the compressor.

1. Remove the coupling guard(s) (if fitted).

2. Break the coupling(s).

3. Remove the coupling hub(s) from the compressor shaft(s) as follows:

   a. Assemble the tools as shown on the Coupling Mounting Tools drawing and the Compressor Assembly drawing, with the nut backed off to give approximately 1/4 inch between the coupling hub face and the sleeve.

   b. Operate the hydraulic pump to build up sufficient pressure (approx. 20,000 to 25,000 psi to start) to move the coupling hub down the taper. When the hub contacts the sleeve, maintain pressure as required to keep the hub expanded and back off the checknut slowly until the hub is free.

   c. When the hub is free on the taper, remove the tools, checknut and hub.

4. Remove the bearing bracket end covers and the bearing bracket caps.

5. Remove the split thrust bearing shims, the split thrust bearing rings and the outer oil guard.

6. Remove the base ring keys, turn and remove the base ring halves, the thrust shoes and the leveling plate.

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7. Refer to the Thrust Collar Locking Arrangement drawing in the last section. Remove the thrust collar and inner oil guard after removing the setscrews, backing off checknut "D", removing the split wedge ring "C", and backing off checknut "A".

8. Remove the split main bearing housing retaining rings and the main bearings, the retaining ring grooves may be used for prying.

   NOTE: The rotor will now be resting on the internal labyrinths and should not be moved any more than absolutely necessary.

9. Remove the checknut and seal collar. Do not lose the two seal collar drive pins. Particular care should be taken to protect the seal collar faces, seal rubbing areas and the shaft shoulders which locate the seal collars.

10. Remove the shaft seal assemblies. The shaft seal nose piece has two pulling holes which may be used. These holes are tapped 10-24. Extreme care should be exercised to avoid scratching or chipping the carbon seal face. The seal assembly should not be disassembled in the field. The seal assembly should be returned to DE LAVAL for any overhaul or rework which may be required. The carbon seal face should be protected by several layers of tissue or a felt lined cover and the entire assembly should be securely boxed for return shipment. Do not pack the seal in excelsior, cotton batting or like materials.

11. Remove all pipe connections attached to the case cover which will interfere with lifting the cover and all fittings such as slight flow indicators and thermometers which might be damaged during disassembly.

12. Remove all bolts and dowel pins in the case cover flange. Fit the case cover lifting guide studs.

13. Fasten the hoisting gear to the case cover and take a slight strain.

14. Clean, sweep and dust all parts.

15. Break the case flange joint by the use of jack bolts.

16. Lift the case cover, checking each one-half inch of travel to insure level hoisting. Insert blocks under the cover flange as the cover is raised. The upper level of the blocks should be within a short distance of the lower face of the cover flange. The cover can then fall only a short distance if the hoisting gear gives way.

17. Setting the case cover down in an inverted position facilitates the removal of the upper halves of the diaphragms, diffusers, diaphragm rings (if

fitted), inlet guide vanes, case rings and diaphragm bushings after the holding screws and pins are removed. The diffuser holding screws should not be removed until after the diaphragm halves have been removed.

18. Make provisions for setting the rotor down on a suitable support.

19. Attach lifting slings to the rotor. Place waste or rags between the slings and the rotor to avoid damaging machined surfaces.

20. Raise the rotor, checking to see that it is parallel to the compressor case at all times. Follow up with blocks as with the case cover.

21. Set the rotor down on the previously prepared support.

22. Do not disassemble the rotor. It must be returned to the factory for any repairs or rebalancing.

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COMPRESSOR ASSEMBLY - Assembly of the compressor is essentially the reverse of disassembly. The following precautions should be observed.

1. Make sure that all parts and the interior of the casing are clean and free from foreign matter and are kept clean and free from foreign matter.

2. All bearings should be thoroughly cleaned and well oiled before the rotor is reinstalled in the compressor.

3. If the thrust collar has been removed it should be replaced in accordance with the instruction given on the TYPICAL THRUST COLLAR LOCKING ARRANGEMENT sheet.

4. All setscrews should be carefully staked so they cannot back out.

5. The ammonia compressor casing horizontal joints should be made up using Permatex 1282 or CYL-SEAL. The same sealant should be used on the horizontal joint faces of the diaphragms and inlet guide vanes. Do not use the sealant under the bearing bracket caps. All other joints are metal-to-metal and no gaskets should be used, although sealing varnish or shellac may be used.

6. With the case cover off and the rotor resting in the main bearings adjust the axial position of the rotor. Four factors must be considered when setting the axial position of the rotor. First the wheels must be centered with respect to their diffusers. Second the rotor must be centered with respect to all of its step type labyrinth seals. Third the rotor thrust bearing must be set to the proper end play. Fourth the proper shaft seal operating dimensions must be maintained. Setting the axial position of the rotor is best accomplished by using a dial indicator against either end of the shaft, and by proceeding as follows:

   a. Carefully check the setting of the wheels with respect to their diffusers as shown on the compressor assembly drawing. Then check to see that the wheels are not rubbing on the case ring labyrinths.

   b. While maintaining the previously established rotor position set all the contoured case rings to give the rotor end play as shown on the compressor assembly drawing. The position of these contoured case rings can be adjusted with shims. This rotor end play should be centered on the rotor position established in step "a". Check to see that the wheels do not rub on the case rings at any point.

   c. While maintaining the rotor position established in step "a" set the thrust bearing shims to give the thrust bearing end play shown on the compressor assembly drawing. This thrust bearing end play should be centered on the proper rotor position established in step "a".

d. Before installing the cover check to see that all labyrinths assembled with it are properly positioned.

7. In replacing the case cover, make sure that the diaphragms, inlet guide vanes, case rings and diaphragm bushings are not damaged. It may be necessary to loosen the bolts holding the lower bearing brackets to the case to free the joint between the upper bearing brackets and the case cover while the case cover is being installed. Do not loosen the lower bearing brackets more than necessary. Carefully retighten the lower bearing brackets to reestablish the rotor alignment.

8. Recheck the rotor end play set in step 6b after the case cover is installed.

9. With the rotor in the position established in step 6 temporarily install the seal collars and their checknuts (do not tighten the checknut setscrews) and check the collar and seal installation.

10. Check the contact between the seal collars and their respective shaft shoulders with Prussian blue. At least 75 percent of the mating area should show contact, with the mating surfaces showing a solid ring of contact and no high spots indicated at the outer diameter of the shaft shoulders.

11. Check to make sure that the operating length of each of the two shaft seals, as measured to the outer seal collar faces, must be within the limits shown on the compressor assembly drawing.

12. Remove the seal collars, install the seals and reinstall the seal collars and checknuts. Tighten the checknut setscrews.

13. Recheck the rotor position.

14. To install couplings, proceed as follows:

a. Place the coupling hub on the tapered shaft and push it as far as it will go by hand without the "O" ring and leather back up washer installed in the bore. Mark this position. Remove the hub and install the "O" ring and leather washer. Remount the hub on the shaft.

b. Refer to the Coupling Mounting Tools drawing in the last section. Install the tools as shown. Install the pump and fittings as shown.

c. Operate the hydraulic pump and turn the nut to expand the hub and move it onto the shaft. A wrench may be installed at the opposite end of the shaft and used to prevent the assembly from turning.

Rev. 3/65 MC

1581 Pt. 1

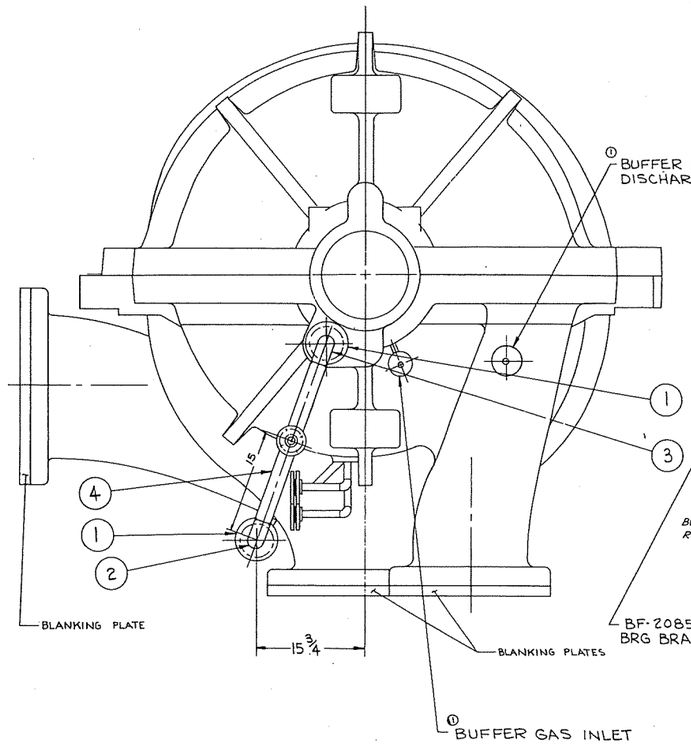
d. Continue to move the hub up the taper until it has reached the position shown on the Compressor Assembly drawing.

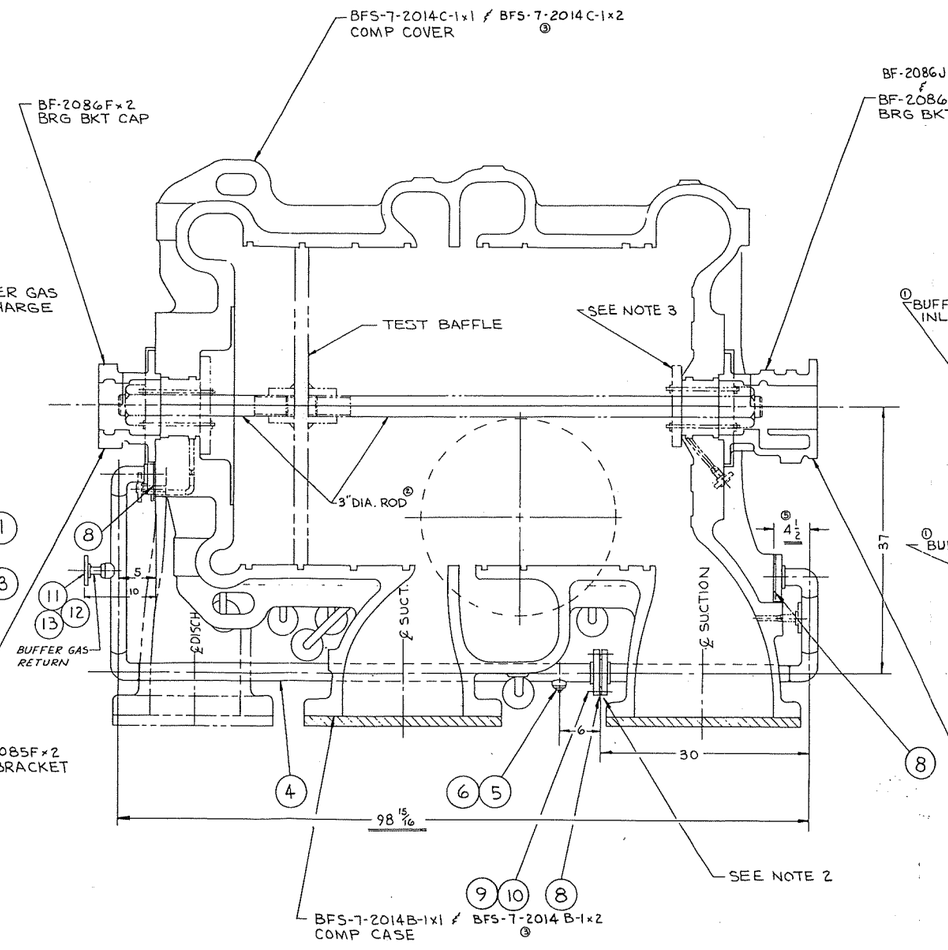
e. Relieve the pressure and drain the oil trapped between the wheel and the shaft.

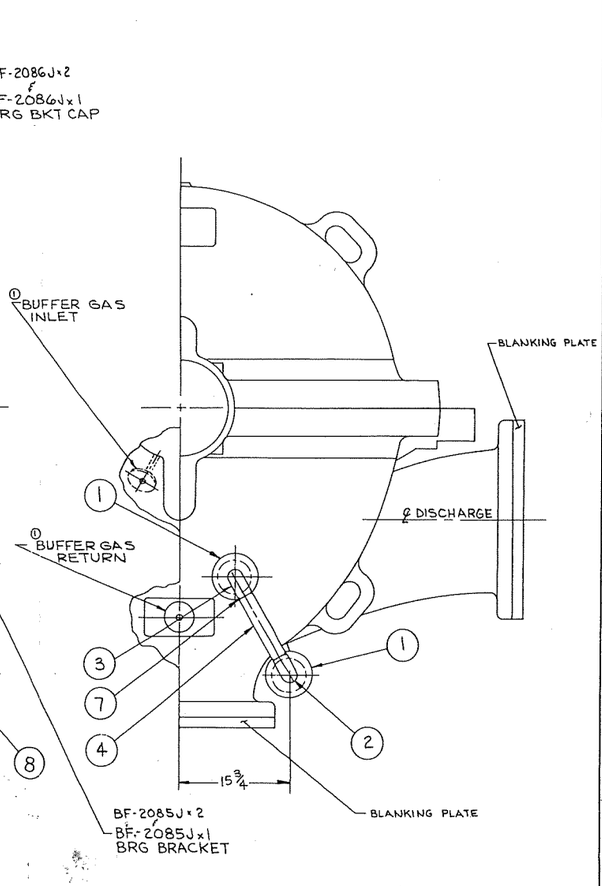
f. Remove the coupling mounting tools.

F-6829

QTY	SYMBOL	DESCRIPTION	MATERIAL	PROC. SPEC.	WT. POUNDS	LBS. PER FT.	PT. NO.
4	2-300#	FLG SOC WLD	A181GR1	012190			1
2	2.00 SCH 80	ELL 90° LR BW	A106GRB	012270			2
2	2.00 SCH 80	ELL 90° LR BW LG TAN	A106GRB	012943			3
1	2.00 x 11FT	PIPE SCH 80 CUT TO SUIT	A106GRB	009276			4
1	2 x 3/4	THREADOLET	312554				5
1	.75 N.P.T.	PLUG SQ HD	A105GR2	012090			6
6	2.00 SCH 80	RING, WELD	STL	012248			7
3	CG-6G	GASKET FLEX	SST	320085			8
8	.62-11x3.50 LG	STUD CONT THD	0484	004584			9
16	.62-11	NUT, FAS	0205	001095			10
④ 1	2" x 1"	SOCKOLET	A105GR2	312549			11
1	1.00/150#	FLG. SOC. WLD	A181GR1	012177			12
1 PC	1.00 x 3.00/SCH 80	PIPE (CUT TO SUIT)	A106GRB	009273			13







NOTES
1. HYDROSTATIC TEST CASE & COVER WITH WATER & PERMASOL #60 AT 225 PSIG @ SUCT. & 450 PSIG @ DISCH. TEST ENTIRE CASE FOR 6-HOURS AT 225 PSIG. CASING IS NOT TO BE SLUSHED, AND JOINT FACES ARE TO BE MADE UP WITH PERMATEX #1282 (FOR HYDROSTATIC TEST ONLY, USE USUDURIAN) ⑥
2. COLD SPRING TO GET .075 GAP BEFORE BOLTING UP.
3. REMOVE BRACKETS & BLANK-OFF BOTH ENDS OF CASE.

7CK, 20/18/18/14

ZONES	ENG.	ALTERATIONS	DATE	BY	CHKD	WHY
G-1	6	REVISED HYDRO. TEST NOTE	3-16-66	WCW	WCW	A
C-2	5	DIM. WAS 5"				
B-4	4	PT" 11 TO 13 ADDED	5-13-65	WCW	WCW	R
D-3 D-1	3	NEW SYMBOLS ADDED	1-5-65	WCW	WCW	R
E-2	2	ADDED 3" DIA. RODS	4-7-64	ABLD	DP	A
	1	BUFFER PIPES ADDED	12-17-63	BMD	WJ	R

MACH. TOL. NOT OTHERWISE SPEC. DECIMAL ± .005 FRACTIONAL ± 1/64 BEVEL CORNERS .015" = .005" ▽ FINISH FOR CHANNELS, ▽ FINISH FOR CRANKS, PLATES, SHAFTS, CONCENTRIC, PROJ. SURFACES, ROUNDED CORNERS

DE LAVAL TURBINE INC. TRENTON, N. J.

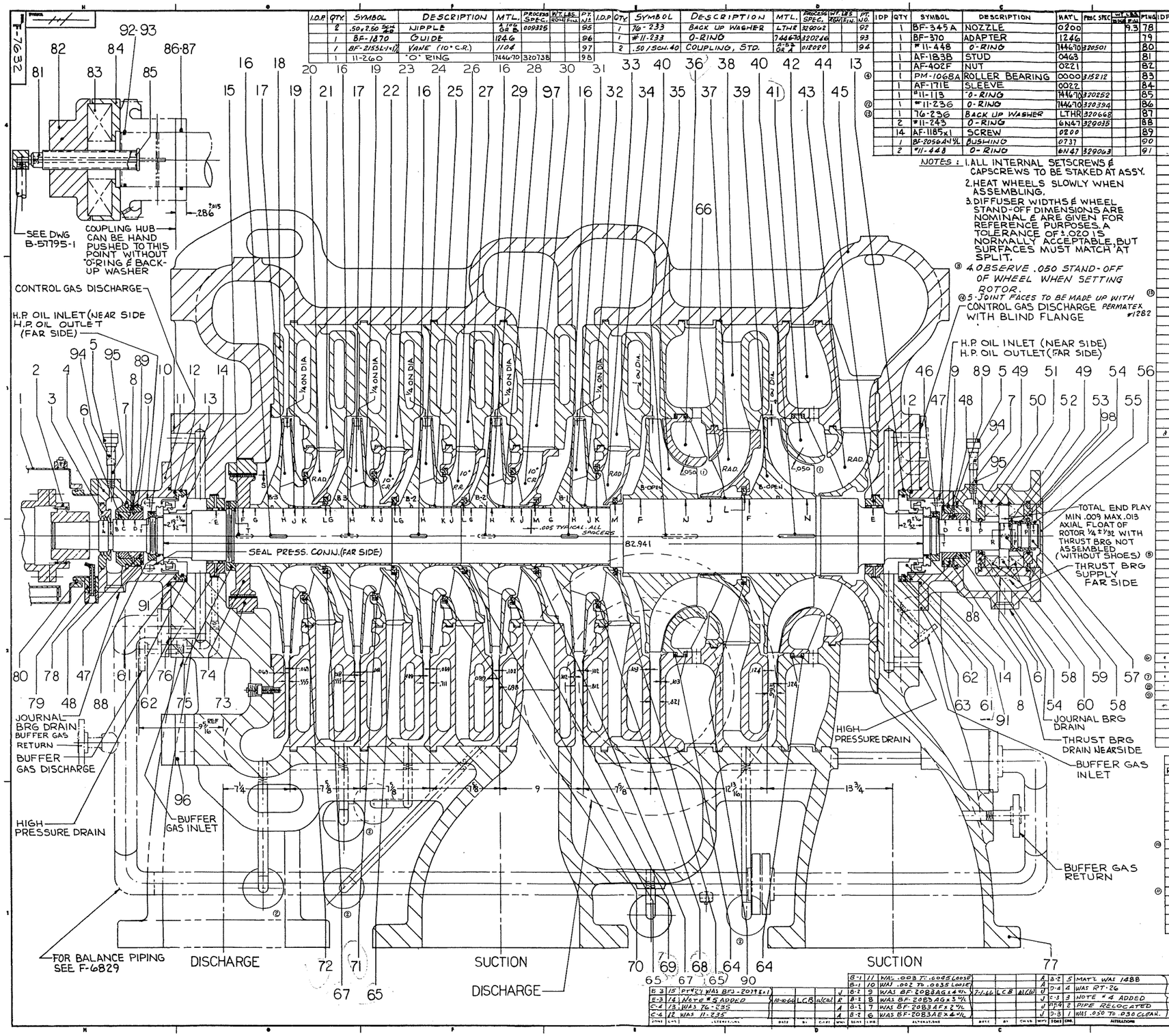
TITLE: LOCATION OF BRACKETS & BALANCE PIPING FOR BFS-7-2014B(x)

	DATE	BY
DRAWN	11-29-64	BMD
CHECKED	12-1-64	GW
APPR.	12-2-64	GW
ENGRG. APP. METHODS	12-4-64	PK
APPROVED TO MFG.	12-11-64	

SCALE 1 1/2" = 1'-0" | TYPE | CLASS | FIRST ISSUE 702598 | SYMBOL

DWG. F-6829

F-7632



I.D.P.	QTY.	SYMBOL	DESCRIPTION	MTL.	PROCESS SPEC.	WT. LBS ROT'L	WT. LBS FIX'D	PT. NO.
	2	.50 x 2.60 SCH 40	NIPPLE	A 106 GR B	0093325			95
	1	BF-1870	GUIDE	1246				96
	1	BF-2155L-1 1/4	VANE (10° C.R.)	1104				97
	1	11-260	'O' RING	7446-70	320738			98

I.D.P.	QTY.	SYMBOL	DESCRIPTION	MTL.	PROCESS SPEC.	WT. LBS ROT'L	WT. LBS FIX'D	PT. NO.
	1	76-233	BACK UP WASHER	LTHR	320002			92
	1	#11-233	O-RING	7446-70	320246			93
	2	.50 / SCH. 40	COUPLING, STD.	A-53 GR B	0182050			94

I.D.P.	QTY.	SYMBOL	DESCRIPTION	MAT'L	PROC SPEC	WT. LBS ROT'L	WT. LBS FIX'D	PT. NO.
	1	BF-345A	NOZZLE	0200			9.3	78
	1	BF-370	ADAPTER	1246				79
	1	#11-448	O-RING	7446-70	320501			80
	1	AF-183B	STUD	0463				81
	1	AF-402F	NUT	0221				82
④	1	PM-1068A	ROLLER BEARING	0000	315212			83
	1	AF-171E	SLEEVE	0022				84
	1	#11-113	O-RING	7446-70	320252			85
②	1	#11-256	O-RING	7446-70	320394			86
③	1	76-236	BACK UP WASHER	LTHR	320668			87
	2	#11-245	O-RING	6N47	329035			88
	14	AF-1185x1	SCREW	0200				89
	1	BF-2056AN 1/4	BUSHING	0737				90
	2	#11-448	O-RING	6N47	329043			91

QTY	SYMBOL	DESCRIPTION	MAT'L	PROC SPEC	WT. LBS ROT'L	WT. LBS FIX'D	PT. NO.
1	BF-449E 1/4	GUARD	1246			64	
1	PM1624A	COUPLING (103, CL-1)	0000				2
1	BF-588G 1/4	GUARD	0737			7	3
1	BF-2086F x 2	CAP	1113			20	4
2	A-153 A B	FILTER, AIRMAZE	0000	311315			5
2	BF-395A	BEARING (5 PADS) PER	0211			7	6
2	AF-692Cx1	RING	0463			.8	7
2	BF-694A	HOUSING	0211			9	8
2	#11-259	O RING	6N47	329031			9
1	BF-402Rx1	NUT	0221			2.5	10
1	BF-2085F x 2	BRACKET	1113			96	11
2	#11-270	O RING	6N47	329032			12
2	#11-447	O RING	6N47	329033			13
2	PM-2052A	SEAL	0000				14
1	AFS-442 G	KEY	0220			06	15
5	AFS-442Gx4	KEY	0220			39	16
2	BF-2079AA x 6	WHEEL	0507			230	17
1	BF-2054Lx1 1/4	DIFFUSER	1246			285	18
2	BF-2051E	SPACER	1463			5.4	19
1	BF-2155M x 1/8	VANE (RAD.)	1104			120	20
1	BF-2152A 3x1 1/4	DIAPHRAGM	0109			884	21
1	BF-2155M-1 x 1/4	VANE (10° C.R.)	1104			120	22
1	BF-2152A 3x2 1/4	DIAPHRAGM	0109			884	23
1	BF-2079Z x 2	WHEEL	0507			250	24
1	BF-2051E x 1	SPACER	1463			3	25
1	BF-2155L-2 x 1/4	VANE (10° P.R.)	1104			96	26
1	BF-2152A 3x3 3/4	DIAPHRAGM	0109			884	27
1	BFS-2051x3	SPACER	1463			4	28
1	BF-2079Zx1	WHEEL	0507		⑫	126	29
1	BFS-2152A x 1/4	DIAPHRAGM	0109			1100	30
1	BF-2079W x 1	WHEEL	0507			126	31
1	BF-2051E x 2	SPACER	1463			3	32
1	BF-2155K x 2 1/4	VANE (RAD.)	1104			102	33
1	BF-2152D-4 1/4	DIAPHRAGM	0109			880	34
1	BF-2077G x 6	WHEEL	0507			127	35
1	BFS-2083E x 1/4	RING	1109			.55	36
1	BFS-2155G x 1/4	VANE (RAD.)	1104			.90	37
1	BFS-2152B x 1/4	DIAPHRAGM	0109			350	38
1	BF-2077G x 4	WHEEL	0507			315	39
2	AFS-442G x 6	KEY	0220			.13	40
1	BFS-2083D x 6	RING	1109			72	41
1	BFS-2152 x 3/4	DIAPHRAGM	0109			910	42
1	BFS-2155F x 1/4	VANE (RAD.)	1104			100	43
1	BF-2041N 1/4	RING	0737			5	44
1	BFST-2040C 1x2	CASE	1109			340	45
1	BF-402R	NUT	0021			2.5	46
2	#11-256	O RING	6N47	329030			47
2	BF-215C	BUSHING	0211			13	48
2	BB-298C x 1/4	SHIM	0204			3.1	49
1	BF-2086J x 2	CAP	1113			85	50
1	LC-264 x B	ORIFICE (7/32 DIA)	0200				51
1	AF-402E x 1	NUT	0463			.62	52
1	AF-692B	RING	0463			2.8	53
2	BF-1180D 1/4	RING	0022			12	54
1	AF-402K	NUT	0463			.8	55
1	BF-595B	COVER	0204			331	56
1	BFS-2052F x 2	SHAFT	0335			855	57
2	AF-588K	GUARD	0737			24	58
1	AF-442B x 2	KEY	0220			.03	59
1	PM1076E (42)	KINGSBURY BRG	0000				60
2	83501D x .275 CS	O-RING	6N47	329038			61
2	BF-171G	SLEEVE	1246			10	62
1	BF-2085J x 2	BRACKET	1113			200	63
4	BFS-298 1/4	SHIM	0022			8	64
3	BF-2076 x 1/4	BUSHING	0737			3.8	65
1	BF-2051B x 1	SPACER	1463			42	66
2	BF-2076 x 2 1/4	BUSHING	0737			3.8	67
1	BF-2083AE x 2 1/4	RING	0737		⑥	5	68
1	BF-2083AF x 1/4	RING	0737			4.6	69
1	BF-2083AF x 1 1/4	RING	0737		⑦	4.4	70
1	BF-2083AG x 2 1/4	RING	0737		⑧	8.6	71
1	BF-2083AG x 3 1/4	RING	0737		⑨	3.8	72
1	BF-2041R 1/4	RING	0211				73
1	BF-2067 K x 1	RING	1401				74
1	BF-4026 x 2	NUT	0221			6.5	75
1	BF-2041P 1/4	RING	0737			6	76
1	BFST-2014B 1x2	CASE	1109			1350	77

NOTES:
1. ALL INTERNAL SETSCREWS & CAPSCREWS TO BE STAKED AT ASSY.
2. HEAT WHEELS SLOWLY WHEN ASSEMBLING.
3. DIFFUSER WIDTHS & WHEEL STAND-OFF DIMENSIONS ARE NOMINAL & ARE GIVEN FOR REFERENCE PURPOSES. A TOLERANCE OF ±.020 IS NORMALLY ACCEPTABLE, BUT SURFACES MUST MATCH AT SPLIT.
④ 4. OBSERVE .050 STAND-OFF OF WHEEL WHEN SETTING ROTOR.
⑤ 5. JOINT FACES TO BE MADE UP WITH CONTROL GAS DISCHARGE PERMATEX #1282

DIAMETRAL CLEARANCES

REF	CLEARANCE INCHES	BETWEEN
A	.018 TO .024	SHAFT(51) & GUARD(3)
B	.014 TO .017	SHAFT(51) & HOUSING(8)
C	.004 TO .007	SHAFT(51) & BEARING(6)
D	.004 TO .006	SHAFT(51) & BUSHING(48)
E	.015 TO .019	SHAFT(51) & RING(44 & 76)
F	.0085 TO .010 SHRINK	SHAFT(51) & RING(74), WHEEL(35&39)
G	.0065 TO .008 SHRINK	SHAFT(51) & WHEELS(17,24,29 & 31)
⑩ H	.007 TO .0085 LOOSE	SHAFT(51) & WHEELS(17,24,29 & 31)
J	.001 SHRINK .0005 FIT LOOSE FIT	SHAFT(51) & SPACERS(19,25,28,32 & 66)
K	.025 TO .029	WHEELS(17,24,29,31) RINGS(71,10,69,68&70)
L	.020 TO .024	WHEELS(17,24,29&39) BUSH(90 & 65)
M	.020 TO .024	BUSH(66&69) SPACER(28), SHAFT(51)
⑪ N	.013 TO .0145 LOOSE	SHAFT(51) & WHEEL(95 & 39)
P	.002 TO .004	SHAFT(51) & GUARD(58) NUT(52) NUT(59) & GUARD(58)
R	.001 TO .003	SHAFT(51) & KINGSBURY BRG(60)
S	.013 TO .017	RING(14) & RING(73)
T	.001 TO .003	SHAFT(51) & NUTS(10,46,55 & 75)

DE LAVAL TURBINE INC. TRENTON, N. J.

TITLE: COMPRESSOR ASSEMBLY & RUNNING CLEARANCES

DRAWN	A.Z. 3-24-66	SCALE	3"=1'-0"
CHECKED	3-24-66 A.Z.	TYPE	OTHER
APPR.	5-5-66	CLASS	B
BOOKS APPR.	5-5-66	ORIG.	703428
BLUEPRINTS APPR.		STENCIL	
ENGR. APPR.	5-5-66		

7CK, 20/14

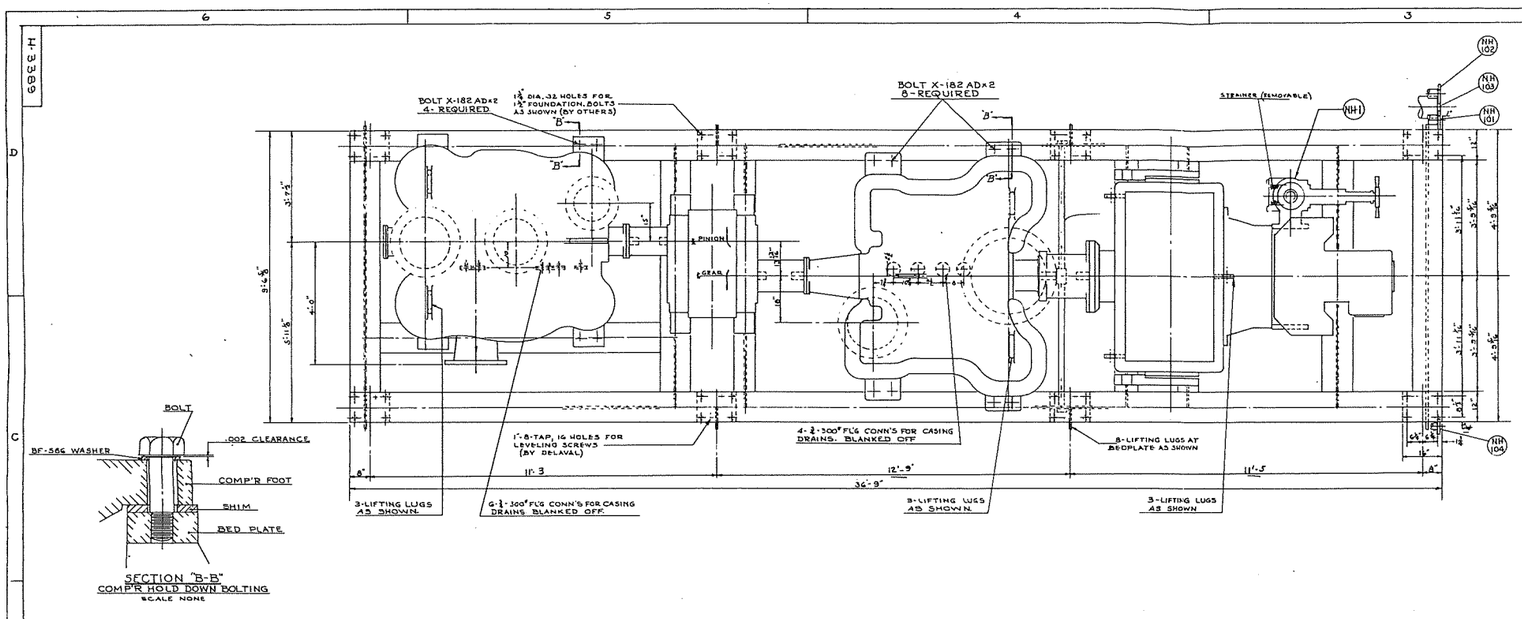
B-3	15	PT'N'S WAS BFJ-2079 & 1			J	B-1	11	WAS .003 TO .0095 LOOSE			A	B-2	5	MAT'L WAS 1488			R
E-3	14	NOTE "5 ADDED	10-8-66	LCB	R	B-1	10	WAS .002 TO .0035 LOOSE			A	D-4	4	WAS PT. 26			R
C-4	13	WAS 76-235			A	B-2	9	WAS BF-2083AG x 1/4	7-1-66	LCB	U	D-4	4	WAS PT. 26			R
C-4	12	WAS 11-235			A	B-2	8	WAS BF-2083AG x 3 1/4			J	C-3	3	NOTE "4 ADDED	7-1-66	LCB	R
						B-2	7	WAS BF-2083AF x 1/4			J	B-3	2	PIPE RELOCATED			A
						C-4	6	WAS BF-2083AE x 1/4			J	D-3	1	WAS .030 TO .030 CLEAR.			A

REPRO FROM F-7256

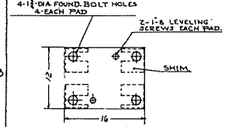
A "B" FRAME

SEE DWG H-4010 LOCATED IN 105-J FILE NH3 I

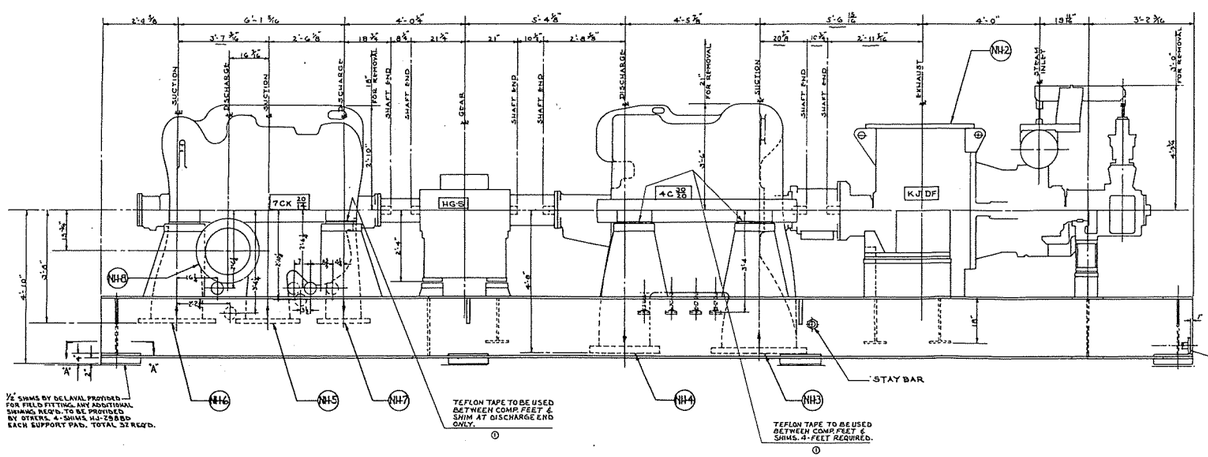
H-3389



SECTION "B-B"
COMP'R HOLD DOWN BOLTING
SCALE NONE



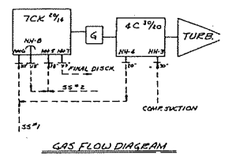
SECTION "A-A"
TYP. FOUND. SUPPORT PAD
IN-6- PLACES AS SHOWN
SCALE 1¼"=1'-0



½" SHIMS BY DELAVAL PROVIDED FOR FIELD FITTING, ANY ADDITIONAL SHIMING NEED'D TO BE PROVIDED BY STRUCT'L. 4-SHIMS, #2-2588D EACH SUPPORT PAD. TOTAL 32 REQ'D.

① TEFLON TAPE TO BE USED BETWEEN COMP FEET & SHIM AT DISCHARGE END ONLY.

① TEFLON TAPE TO BE USED BETWEEN COMP FEET & SHIMS, 4-FEET REQUIRED.



GAS FLOW DIAGRAM

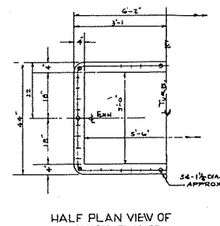
MAJOR EQUIPMENT CONNECTIONS

IDENT.	PURPOSE	FLG SIZE	ANSI RATING	FLG FACE B.F.	NO. OF BOLT HOLES	O.D.	FLG THK	DIA. B.C.	NO. OF BOLTS	BOLT DIA.	BOLT HGT.	REMARKS
	FLANGE THICKNESS INCLUDES RAISED FACE				BOLT HOLES ARE ½" LARGER THAN BOLT DIA.							
NH-1	TURB. INLET	6"	600#	8½	14	2⅝	11½	12	1"	7½"		SEE DETAIL
NH-2	TURB. EXHAUST					1⅜						
NH-3	COMP. SUCTION	30"	125#		28	30⅝	1 2⅜	36"	28	1⅛"		
NH-4	COMP. DISCHARGE	20"	125#		20	30⅝	2 ⅜	25"	20	1⅛		
NH-5	COMP. SUCTION	18"	250#		28	23	2¾	24¾	24	1⅝"		
NH-6	COMP. SUCTION	20"	125#		20	27½	2⅝	25"	20	1⅝"		
NH-7	COMP. DISCHARGE	14"	250#		20	23"	2 1/16	20½	20	1⅝"		
NH-8	COMP. DISCHARGE	18"	250#		20	20"	2⅝	24¾	24	1⅝"		

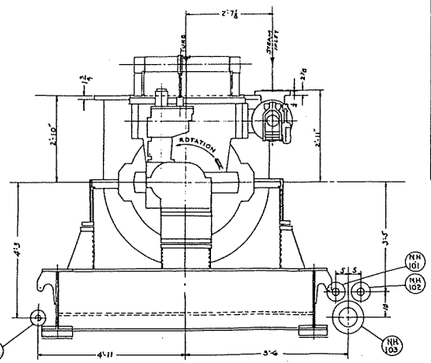
OIL CONNECTIONS

IDENT.	PURPOSE	FLG SIZE	ANSI RATING	FLG FACE R.F.	O.D.	FLG THK	DIA. B.C.	NO. OF BOLTS	BOLT DIA.	BOLT HGT.	REMARKS
	FLANGE THICKNESS INCLUDES RAISED FACE				BOLT HOLES ARE ½" LARGER THAN BOLT DIA.						
NH101	OIL SUPPLY	3	150#	3	7⅞	1 9/16	6	4	⅝	1¼	
NH102	OIL TO BEARING TANK	3	150#	3	7⅞	1 9/16	6	4	⅝	1¼	
NH103	OIL DRAIN	8	150#	10⅝	13¼	1⅞	11¾	8	⅞	1½	
NH104	OIL TO BEARING TANK	2	150#	3½	6	⅝	4¾	4	⅞	1¼	

FOR OIL CONNECTIONS SEE DE LAVAL REF. DWG. 102



HALF PLAN VIEW OF EXHAUST FLANGE

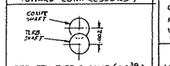


NOTE
FINAL DOWELING OF MACHINERY TO THE BEDPLATE MUST BE DONE BY CUSTOMER IN FIELD AFTER BEDPLATE HAS BEEN FINAL MOUNTED ON ITS SUPPORT PIERS. TEMPORARY DOWELING ONLY IS DONE BY DELAVAL FOR TEST PURPOSES AS NECESSARY.

ALL BOLTS STRADDLE CENTER LINE

COLD SHAFT ALIGNMENT DATA

(LOOKING FROM TURBINE TOWARD COMPRESSORS)



MAINTENANCE WEIGHTS

COMP. UPPER CASE	4C 18/18	15,000 LBS
ROTOR	"	2,500 "
COMP. UPPER CASE	7CK 10/14	13,000 "
ROTOR	"	1,900 "
UPPER CASE HALF	KJ DF	11,000 "
ROTOR	"	3,100 "

DE LAVAL REFERENCE DRAWINGS

102	STEAM SEAL & OIL PIPING ASSEMBLY (UNIT)	H-3 92
103	STEAM SEAL & DRAIN PIPING DIAGRAM	D-4 3986
104	OIL PIPING DIAGRAM (UNIT)	D-3571
105	COMPRESSOR ALLOWABLE FORCES & MOMENTS	CC-3093
106	TURBINE ALLOWABLE FORCES & MOMENTS	CC-3093
107	THERMAL MOVEMENTS STEAM INLET	CC-3091
114	LUBE OIL CONSOLE DIAGRAM	D-3357
115	LUBE OIL CONSOLE PIPING	H-3326

ESTIMATED WEIGHTS

TURBINE KJ	27,300 #
COMP. 4C 20/20	38,800 #
GEAR	4,550 #
COMP. 7CK 10/14	23,000 #
BEDPLATE	31,640 #

1000 TON "NH3"

M.W. KELLOGG CO.
JOB NO. 5376
ITEM NO. 105J
SERVICE: AMMONIA
CLIENT: COMMERCIAL SOLVENTS CORP.
JOB LOCATION: STERLINGTON, LA.
REQUISITION NO. 5376-320-102

DE LAVAL TURBINE INC.
TRENTON, N.J.

FEDERAL STOCK IDENT. NO.	16712	TYPE KJ-DF 4C 20/20 HG-S--7CK 10/14 TURBINE DRIVEN GEARED COMPRESSOR SPEED 6100/8300			
DRAWN	M.H.-6-6	W. A.	SCALE	1/4"-1'-0"	
CHECKED	1-30-46	G.V.L.	TYPE		STOCK
APPR.			SIZE	B	CODE
ENGR. APPR.	1-17-46		DRAWING	703413	
ENGR. APPR.			SERIAL NO.		
DRAWING APPROVED					

4-1-47	1	TEFLON TAPE ADDED TO COMP FEET	1-17-47	F.H.M.	G.V.L.

H-3389