General Index

PART B - MAINTENANCE RECOMMENDATION

1. Turbine
1.1 General
1.2 Main guide bearing - loading - temperature - oil and maintenance
1.3 Guide bearing replacement
1.4 Shaft packing replacement
1.5 Wicket gate breake link replacement
1.6 Wicket gate packing replacement
1.7 Wicket gate linkage adjustment
1.8 Alarm devices
1.9 Turbine dismantling and reassembly
1.10 Governor equipment
1.11 Auxiliary equipment
1.12 Normal operation daily checks
1.13 Normal operation weekly checks
1.14 Normal operation monthly checks
1.15 General welding procedure for runner
1.16 Kaplan runner - dismantling
1.17 Kaplan runner - assembly
1.18 Runner blade seal replacement.

Part C Operating Instructions

Part D Summary of Catalogs

Part E List of Drawings

Part F Erection Procedure - Propeller Units 1 and 2

Part FF Erection Procedure - Kaplan Unit 3.

PART 1 TOWER ASSEMBLY

1.1. BOTTOM RING

1.1.2 Bushing
1.1.3 Discharge ring
1.1.4 Seal ring

1.2 WICKET GATES

1.2.1 Sleeve - upper
1.2.2 Sleeve - intermediate
1.2.3 Sleeve - lower

1.3 HEAD COVER

1.3.1 Liner
1.3.2 Liner
1.3.3 Bushing - upper
1.3.4 Bushing - lower
1.3.5 Packing
1.3.6 Facing plate

PART 2 SUMP PUMP FOR HEAD COVER

2.1 SUMP PUMP ARRANGEMENT

2.1.1 Valve
2.1.2 Check valve
2.1.3 Liquid level control
2.1.4 Liquid level control
2.1.5 Pump and motor
2.1.6 Inverter

PART 3 RUNNER AND SHAFT

3.1 RUNNER

3.1.1 Cone

3.2 SHAFT

3.2.1 Inner oil sump
3.2.2 Seal ring
3.2.3 Coupling bolts - runner end
3.2.4 Nut guard
3.2.5 Coupling stud - generator end
3.2.6 Nuts.

PART 3 RUNNER AND SHAFT (Cont'd)

3.3 SHAFT PACKING SEAL ARRANGEMENT

3.3.1 Shaft sleeve
3.3.2 Lantern ring
3.3.3 Packing
3.3.4 Spacer for packing

Dominion Engineering Works

PART 3A RUNNER

3A.1 RUNNER ARRANGEMENT

3A.1.1 Runner hub
3A.1.2 Seal ring
3A.1.3 Seal ring
3A.1.4 Seal ring

3A.2 BLADE AND LEVER ASSEMBLY

3A.2.1 Runner blade

PART 6A GATE OPERATING RING AND LINKAGE

6A.1 GATE OPERATING RING ARRANGEMENT

PART 7A OIL HEAD, PIPING AND INSTRUMENT PANEL (Cont'd)

7A.2 GOVERNOR PIPING ARRANGEMENT

7A.2.1 Gasket

7A.2.2 Gasket

PART 8 SPARES - PROPELLER UNITS 1 AND 2 (Cont'd)

8.5 COVER PLATE

8.5.1 Packing ring

8.6 OIL LEVEL INDICATOR

8.6.1 Gasket

8.7 LINKS AND LEVERS

8.7.1 Breake link

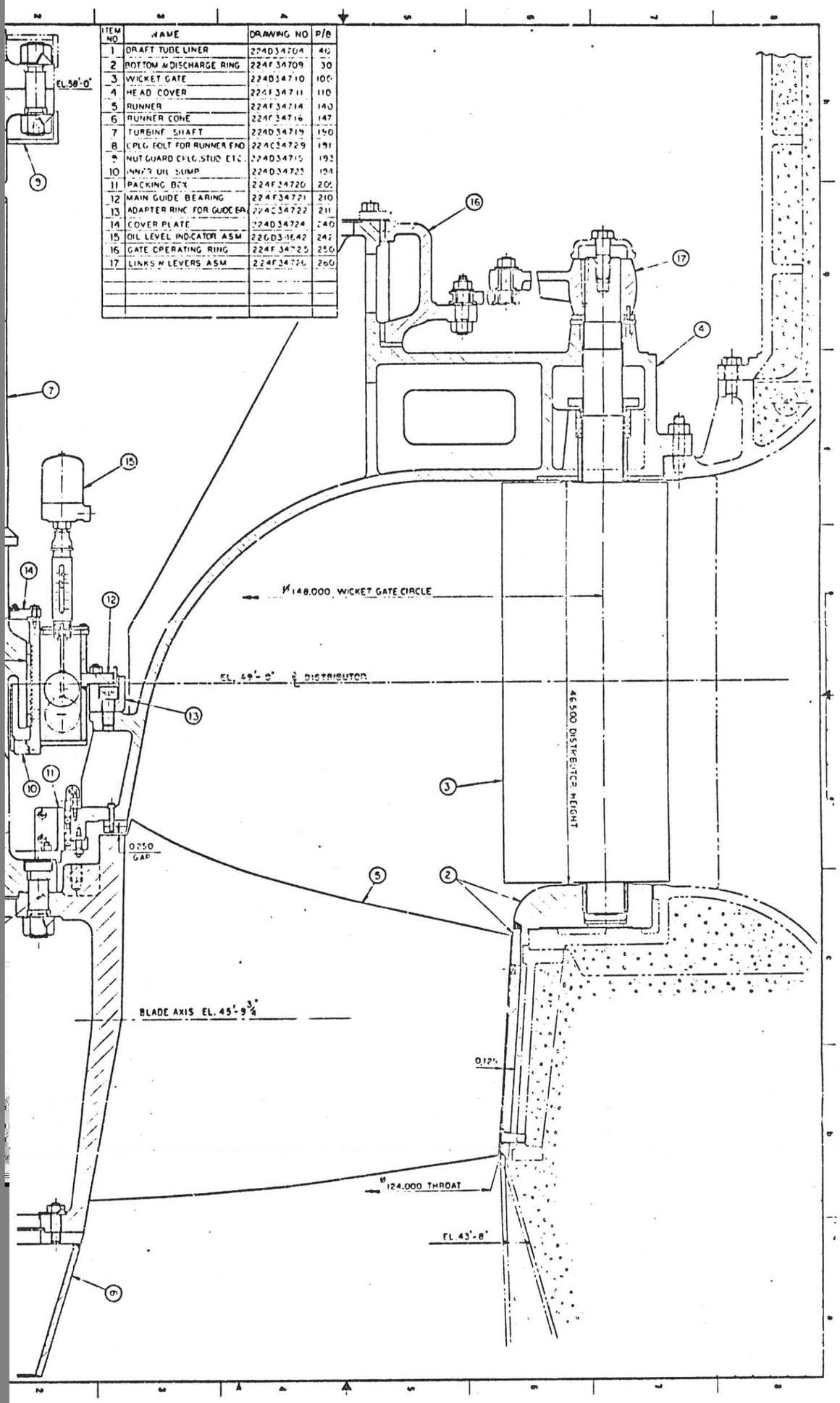
Dominion Engineering Works

PART 8A SPARES - KAPLAN UNIT 3 (Cont'd)

8A.17 OIL HEAD PIPING

8A.17.1 Seal - small pipe and piston extension
8A.17.2 Seal - large pipe, shaft and pipe extension connection

ITEM NO.	NAME	DRAWING NO	P/B
1	DRAFT TUBE LINER	224D34704	40
2	BOTTOM & DISCHARGE RING	224F34709	30
3	WICKET GATE	224D34710	100
4	HEAD COVER	224F34711	110
5	RUNNER	224F34714	140
6	RUNNER CONE	224F34716	147
7	TURBINE SHAFT	224D34719	150
8	CPLG BOLT FOR RUNNER END	224C34729	191
9	NUT GUARD CPLG STUD ETC.	224D34715	193
10	INNER OIL SUMP	224D34723	194
11	PACKING BOX	224F34720	200
12	MAIN GUIDE BEARING	224F34721	210
13	ADAPTER RING FOR GUIDE BEA	224C34722	211
14	COVER PLATE	224D34724	240
15	OIL LEVEL INDICATOR ASM	226D3 1642	242
16	GATE OPERATING RING	224F34725	250
17	LINKS & LEVERS ASM	224F34726	260



ITEM NO.	NAME	DRAWING NO	P/B
1	DRAFT TUBE LINER	224D34704	40
2	BOTTOM & DISCHARGE RING	224F34709	90
3	WICKET GATE	224D34710	100
4	HEAD COVER	224F34703	110
5	RUNNER	224F34714	140
6	RUNNER CONE	224C34716	147
7	TURBINE SHAFT	224D34719	190
8	CPLG BOLT FOR RUNNER END	224C34729	191
9	NUT GUARD CPLG.STUD ETC.	224D34715	193
10	INNER OIL SUMP	224D34723	194
11	PACKING BOX	224C34706	205
12	MAIN GUIDE BEARING	224F34721	210
13	ADAPTER RING FOR GUIDE BR	224C34722	211
14	COVER PLATE	224D34724	240
15	OIL LEVEL INDICATOR ASM	226D34642	242
16	GATE OPERATING RING	224F34725	250
17	LINKS & LEVERS ASM	224F34726	260

EL.58'-0"

Ø13.000

Ø17.000

Ø148.000 WICKET GATE CIRCLE

EL. 49'-0" ℄ DISTRIBUTOR

46500 DISTRIBUTOR WEIGHT

0.250 GAP

BLADE AXIS EL. 45'-9 3/4"

℄ UNIT

0.125

Ø124.000 THROAT

EL.43'-8"

SECTIONAL ELEVATION

5200 HP

150 RPM

2244-300420 20 UNIT #1

CITY OF TALLAHASSEE
JACKSON BLUFF
HYDROELECTRIC PROJECT
PROPELLER TURBINE

2241347C

PART "A" TECHNICAL AND DESIGN DATA FOR PROPELLER TURBINE

Rated head	32 ft.
Maximum head	40 ft.
Output at rated head	6200 HP
Output at maximum head	7650 HP
Synchronous speed	150 RPM
Runaway speed	290 RPM
Rotation - viewing from top	Clockwise
Runner throat diameter	124"
Runner WR^2	90,000 lbs ft^2
Runner diametrical clearances	.250"
Wicket gate pitch circle diameter	148"
Wicket gate angular opening	46'-34'
Wicket gate clearances - upper	.010" to .015"
- lower	.010" to .039"
Number of wicket gates	20
Elevation of distributor centerline	49 ft.
Distributor height	46.500"
Turbine pit diameter	184"
Servomotor normal operating pressure	200 PSI
Servomotor stroke	12"
Maximum Hyd. thrust at maximum head	185,000 lbs.
Estimated total tensile load on shaft @ max. head.	202,525 lbs.

Dominion Engineering Works

PART "A" TECHNICAL AND DESIGN DATA FOR KAPLAN TURBINE

Rated head	32 ft.
Maximum head (Gross)	40 ft.
Output at rated head	3,952 HP
Output at maximum head	5,500 HP
Synchronous speed	180 RPM
Runaway speed	480 RPM
Rotation viewing from top	Clockwise
Discharge ring throat diameter	105 in.
Runner diameter	104.75 in
Runner diametrical clearance	.25 in
Hydraulic thrust per blade	25,053 lbs.
Centrifugal force per blade °SNL	26,423 lbs.
Shaft max. torque - normal	151,547 lbs.
Shaft max. torque - blades jammed	378,869 lbs.
Shaft max. torque - at runaway	303,094 lbs.
Servomotor normal operating pressure	200 PSI
Wicket gate servomotor volume	2,024 in^3
Blade servomotor volume	2,725 in^3
Wicket gate timing	5 sec.
Blade timing	12 sec.
Hydraulic thrust at rated head	130,000 lbs.
Hydraulic thrust at maximum head	160,000 lbs.
No. of wicket gates	18
Wicket gate pitch circle	144 in.
Wicket gate angular opening	55°
Wicket gate design clearances - upper	.010" to .015"
- lower	.010" to .038"
Distributor elevation at centerline	49-0 feet
Distributor height	39 in.

ITEM NO	NAME	DRAWING NO	P/B
1	DRAFT TUBE LINER	224D34704	40
2	BOTTOM & DISCHARGE RING	224F34709	30
3	WICKET GATE	224D34710	100
4	HEAD COVER	224F34711	110
5	RUNNER	224F34714	140
6	RUNNER CONE	224C34716	147
7	TURBINE SHAFT	224D34719	150
8	CPLG BOLT FOR RUNNER END	224C34729	191
9	NUT GUARD CPLG STUD ETC	224D34715	193
10	INNER OIL SUMP	224D34723	194
11	PACKING BOX	224F34720	200
12	MAIN GUIDE BEARING	224F34721	210
13	ADAPTER RING FOR GUIDE BA	224C34722	211
14	COVER PLATE	224D34724	240
15	OIL LEVEL INDICATOR ASM	226D31642	245
16	GATE OPERATING RING	224F34725	250
17	LINKS & LEVERS ASM	224F34726	260

EL. 58'-0"

Ø 13.000

Ø 17.000

Ø 148.000 WICKET GATE CIRCLE

EL. 49'-0" ℄ DISTRIBUTOR

46500 DISTRIBUTOR HEIGHT

0.250 GAP

℄ UNIT

BLADE AXIS EL. 45'-9 3/4"

0.125

Ø 124.000 THROAT

EL 43'-8"

SECTIONAL ELEVATION

6200 HP

150 RPM

CITY OF TALLAHASSEE
JACKSON BLUFF
HYDROELECTRIC PROJECT
PROPELLER TURBINE

224-900420
224-900410
20

DOMINION ENGINEERING WORKS LIMITED
MONTREAL CANADA

224F34700

PART "A" GENERAL DESCRIPTION OF MAIN PARTS

1. DISCHARGE RING - PROPELLER

The discharge ring is made from steel plate 26-1/8" high with maximum diameter of 128-13/16".

The wall thickness after machining is approximately 1 1/8".

The bore of the discharge ring is accurately machined to close tolerance.

The discharge ring after installation, is welded to the bottom ring and the new draft tube liner extension.

Estimated weight of the discharge ring is 3,300 lbs.

2. BOTTOM RING

Bottom ring is made from steel plate with thickness of 5-1/8" after final machining.

The bottom ring is fabricated in halves, which are bolted together at assembly.

Series of bolts hold the bottom ring securely attached to the support, and it incorporates equally spaced plastic bushed bores for the wicket gates.

After alignment completion during the installation process the bottom ring is welded to the discharge ring.

Estimated weight of the bottom is 9.100 lbs.

3. WICKET GATES

The wicket gates are of the fabricated steel construction. Stainless sleeves are installed on the gate stems bearing areas.

Estimated weight of each gate is 600 lbs.

PART "A" GENERAL DESCRIPTION OF MAIN PARTS

4. OPERATING RING

The existing operating ring is of the cast iron construction which has been refurbished to new like condition.

It is connected to two hydraulically operated servomotors which are controlled by the governor.

Through linkage, the operating ring is connected to the wicket gates.

Every second gate is equipped with breake link which is the safety device in case some foreign matter gets entrapped in between the gates.

5. HEAD COVER

The existing head cover is of the cast iron construction made in sections to facilitate its installation.

The head cover distributor surface was remachined and new wear plates installed.

Wicket gate bores were reconditioned to permit the installation of plastic bushings and packings.

The guide bearing supporting flange in the head cover was also remachined to suit the guide bearing of modern design.

Assembled head cover estimated weight is 30.000 lbs.

6. PROPELLER RUNNER - CONE AND SHAFT

A. Runner is of the 5 blades propeller type cast in one piece from stainless steel.

The diameter of the runner is 125 3/4" and 45 1/2" high.

The top section of the runner hub provides mounting flange with precise bored holes permitting the attachment of the main shaft.

The lower end of the runner provides another flange for the runner cone attachment.

Runner estimated weight is 13,000 lbs.

PART "A" GENERAL DESCRIPTION OF MAIN PARTS

6. PROPELLER RUNNER - CONE AND SHAFT (Cont'd).

B. RUNNER CONE.

Runner cone is fabricated from steel plate 3/4" thick.

The upper part is provided with mounting flange for bolting to the runner hub.

The estimated cone weight is 390 lbs.

C. SHAFT

The shaft is made from forged steel and its length is 131.875". The shaft bearing journal is 16.990" diameter with highly polished surface.

The guide bearing inner oil sump is installed below shaft journal and is permanent part of the shaft.

Both ends of the shaft are flanged, accurately machined and drilled for the coupling bolts.

The lower flange top side also serves as a base for the mounting of the sleeve for the shaft packing arrangement.

Shaft estimated weight is 6,000 lbs.

7. GUIDE BEARING

The guide bearing is of the fabricated steel construction. It is constructed in halves and the oil sump is integral part of the bearing assembly.

The bearing height is 16 5/8" with outside diameter of maximum of 36 5/16".

The inner bore is grooved to anchor the babbitt which is then machined to close tolerance to suit the shaft journal.

Once the bearing is installed it forms completely sealed unit.

PART "A" GENERAL DESCRIPTION OF MAIN PARTS

7. GUIDE BEARING (Cont'd)

Instruments are provided to facilitate the temperature and oil level monitoring.

For observation of the internal oil flow within the bearing two clear plastic covered windows are provided in the bearing top.

The guide bearing estimated weight is 750 lbs.

8. PACKING BOX

The shaft packing box is located in the head cover base above the runner hub.

Shaft sleeve is the rotating member of the packing box assembly and is made in halves from 410 type of stainless steel plate. The sleeve outer cylindrical surface is machined to highly polished finish.

The assembled sleeve is mounted and bolted to the top of shaft lower coupling flange.

The packing box arrangement varies between unit one and unit two.

The packing box in unit one is independent assembly bolted to the base of the head cover, while unit two, the head cover base forms part of the packing box with lower adaptor plate and its base.

This is the only difference and in all other respect, the packing box arrangement is identical.

The sealing element of the packing box consist of four square packings with lantern ring in the middle.

The packing is retained in place with gland ring. During operation, the packing is cooled and lubricated with strained water.

PART "A" GENERAL DESCRIPTION OF MAIN PARTS

9. KAPLAN RUNNER

9.1 In the Kaplan runner, the blades may be rotated to the most efficient angle by hydraulic servomotor within the runner hub.

Electronic cam stepping motor in the governor is used to cause the blade angle to change with the wicket gate position, so that high efficiency is always obtained at almost any percentage of the full load.

The hydraulic pressure into the runner hub blade operating servomotor is transmitted from the governor through series of pipes leading at first to the oil head then down to the blade servomotor in the runner hub.

Oil head principal function is to transfer the hydraulic power from stationary component into the rotating one.

9.2 An oil reservoir is placed on the top of the oil head and is connected through single pipe right to the servomotor cylinder piston rod.

This pipe have two functions.

a) It follows the servomotor piston stroke and through linkage in the oil reservoir transmits this information to the blade position indicator and the governor.

b) The pipe is also a passage for the runner hub displaced oil.

Due to the servomotor piston rod movement, the oil volume within the runner hub is changing, and the oil in the reservoir on the top of the oil head compensates for these changes.

The Kaplan runner consist of 5 stainless steel blades, one hub, blade actuating mechanism and upper and lower cone.

PART "A" GENERAL DESCRIPTION OF MAIN PARTS

10. MAIN SHAFT

The shaft is 126.125" long and is made from forged steel.

The bearing journal outside diameter is 14.991" and the journal surface is of highly polished finish.

Both ends of the shaft are flanged, accurately machined and drilled for coupling bolts.

The top flange is made to suit the generator shaft flange and after carefull uncoupled alignment checks, both flanges are pulled and bolted together.

The lower flange is bolted to the runner hub and it serves as a cylinder head and a base for the shaft seal sleeve for the packing.

Guide bearing inner cil sump is installed below the shaft bearing journal and is the shaft permanent component.

Shaft estimated weight is 4,500 lbs..

PART "A" GENERAL DESCRIPTION OF MAIN PARTS

11. DISCHARGE RING - KAPLAN

Discharge ring for the Kaplan turbine is similar in construction to the propeller one.

Plate steel is used for the construction with minimum wall thickness of 1.100" after machining.

The cylindrical bore of the discharge ring is machined to 105.000" to 105.036" and the spherical section at the lower end to 52.500 to 52.525 Radius.

The height of the discharge ring is 24 5/8" with maximum outside diameter of 107 1/4".

The discharge ring after the installation is welded to the bottom ring and the new draft tube liner extension.

Estimated weight of the discharge ring is 2625 lbs.

12. BOTTOM RING

Bottom ring is made from steel plate with thickness of 4" after final machining.

The bottom ring is fabricated in halves which are bolted together at final assembly at site. The bottom ring is attached to the support by series of socket head bolts and its alignment is assured with locating dowel pins.

The bottom ring incorporates 18 equally spaced plastic bushed bores for the wicket gates.

After final alignment, the bottom ring is welded to the discharge ring.

Assembled estimated weight is 6,600 lbs.

PART "A" GENERAL DESCRIPTION OF MAIN PARTS

13. HEAD COVER

The existing head cover is of the cast iron construction made in 3 sections.

The distributor surface was reconditioned with steel wearing plate which is bolted to the head cover.

The wicket gate bores were re-machined to permit the installation of plastic bushings and packing.

To accomodate the shaft packing box, the head cover lower end has been modified with addition of inner head cover.

The assembled head cover estimated weight is 22,000 lbs.

PART "B" MAINTENANCE RECOMMENDATIONS

1. TURBINE

1.1 GENERAL

A program of regular inspection and maintenance should be organized as it will help to obtain trouble-free service from the turbine.

Operating conditions such as hours of operation per year, average and peak loadings, water condition, will all influence the amount of maintenance work necessary.

Those parts that experience has shown may require maintenance are identified on the following pages with comments and recommendations.

1.2 MAIN GUIDE BEARING

1.2.1 Dominion turbine guide bearing is of the viscosity pump type. The oil is forced along horizontal groove in the babbitt by the rotation of the shaft journal, up the vertical grooves and into the bearing discharge openings.

1.2.2 The temperature at which the bearing will operate depends on the peripheral speed, the radial clearance and the oil viscosity.

1.2.3 It is not practical to predict the temperature at which the bearing will operate. Acceptable running tempature can cover a fairly broad range.

1.2.4 It is essential to observe the bearing temperature upon initial start up, after bearing maintenance or replacement.

Note the bearing temperature when unit is running at synchronous speed for period of time with temperature leveled off.

It should be pointed out that in some cases, stable operating temperature of between 65° and 70°C can be acceptable.

PART "B MAINTENANCE RECOMMENDATIONS

1.2 MAIN GUIDE BEARING (Cont'd).

1.2.5 The life of a bearing assembly is dependent upon a number of inter-related factors.

a) loading
b) temperature
c) type of oil
d) quality of oil and
e) maintenance practices.

1.2.6 LOADING

Overloading increases all the internal stresses in the machine, including the bearing loading. If the design limits are exceeded, wear tends to accelerate, resulting in reduction of the time between major bearing overauls.

1.2.7 TEMPERATURE

Bearing temperature control is important and is influenced by factors such as:

a) Machine loading
b) Oil level
c) Oil viscosity and
d) Oil quality.

Machine control is within the control of the operator. Exceeding the temperature reduces the viscosity of the oil and may affect the lubrication of the bearing. Higher temperatures also promote oxidation and other chemical changes in the oil.

1.2.8 TYPE OF NEW OIL

The following table show typical properties and values for acceptable new oil for use in guide bearings of vertical hydraulic turbines.

It is most important to observe and adhere to the "CAUTION" in the lower part of the table.

Conduct a complete analysis of all incoming new oil and retain a copy of the test report as an historical reference for future use.

PART "B" MAINTENANCE RECOMMENDATIONS

Specific Gravity (ASTM D1298)	0.88-0.89
Colour (ASTM D1500)	1-3
Viscosity centi-stokes (ASTM D455)	SUS
at 40°C 43.0-65.1	(200-302)
at 100°C 6.3-8.26	(46-52)
Viscosty Index (ASTM D2270)	90 Min.
Pour Point (ASTM D97) °C	-5 Max.
Flash Point (ASTM D92)°C	210 Min.
Rust Preventive Characteristics (ASTM D665)	Pass
Neutralization Number (ASTM D974) mg KOH/g	0.1 Max.
Reaction to Copper (ASTM D130)	1. Max.
Oxidation Characteristics (ASTM D943) hours	1000 Min.
Emulsion Characteristics (ASTM D1401) minutes	
Distilled Water 54.4°C	30 Max.
1% Salt Water 54°C	30 Max.
Sulphate Residue (ASTM D874) % Weight	0.001 Max.
Sulphur (ASTM D129)% Weight	0.001 Max.
Insolubles (ASTM D893)% Weight	0.001 Max.
Water Content (ASTM D1744) ppm	50 Max.
Precipitation Number (ASTM D91	0.1 Max.

Note: At the temperatures previously used for oil viscosity determinations, these values correspond to:

100°F 48. 7-71.5 cSt (225-328 SUS) 210°F 6.5-8.53 cST (47-54 SUS)

CAUTION: Do NOT use bearing lubricating oil which contains extreme pressure type anti-wear additives.

1.2.9 BEARING MAINTENANCE

a) Maintenance of the correct oil level and occasional draining and replacement of the oil is all that should be required during many years of service, provided that dirt and water are kept out of the bearing.

b) All operating and maintenance personnel should take special care to prevent any foreign matter from getting into the bearing. The bearing housing cover plate should be kept clean at all times.

c) A humid atmosphere may result in condensation inside the bearing housing which settles to the bottom of the sump. If this is happening, the water should be drained out at regular intervals. The oil should be changed more frequently since oil and water form an emulsion with inferior lubricating properties.

PART "B" MAINTENANCE RECOMMENDATIONS

1.2.9 BEARING MAINTENANCE (Cont'd).

d) At initial start, the oil purity must be observed for possible metal or water contamination. Bearing sump should be checked for oil leaks.

e) A close and thorough inspection must be carried out at regular intervals.

f) Depending on overall general condition, the oil shall be completely drained, the sump flushed, and oil after treatment returned or replaced with filtered new oil.

1.3 GUIDE BEARING REPLACEMENT

224C34722 224D34723.

PART "B" MAINTENANCE RECOMMENDATIONS

1.3 (cont'd).

1.3.6 Remove all other electrical conduits or water piping which may interfere with guide bearing removal.

1.3.7 Drain all oil from the guide bearing sump into a convenient container.

1.3.8 Remove turbine-generator coupling bolts lower nut guard, Dwg. 224D34715.

1.3.9 With reference to Dwg. 224D34724, dismantle and remove from the bearing cover plate the shaft felt seal Pc. 6, with the retaining ring Pc. 5.

1.3.10 Remove from the cover plate the two fitted stud bolts Pc. 9.

1.3.11 Remove the 12, 1/2" capscrews Pc. 8, securing the cover plate Pc. 1, to the bearing.

Mark the cover plate exact position with respect to the intake centerline then remove.

1.3.12 With reference to dwg. 224D34723 Zone 6-3. Bolt two lifting brackets to the inner oil sump.

1.3.13 Attach come-a-longs etc., to the base of turbine generator coupling bolts and via slings to the inner oil sump lifting brackets.

When ready remove the four radial 1/2" capscrews Pc. 26, and washers Pc. 27, from the bearing inner oil sump assembly, see Dwg. 224F34721, Sheet 1, Zone e-2.

[redacted]

PART "B" MAINTENANCE RECOMMENDATIONS.

1.3 (Cont'd).

1.3.17 Rest the guide bearing on the platform. Remove 2 taper pins from each joint then remove nuts Pc. 18.

Carefully split the bearing and remove from turbine pit.

1.3.18 Replacement bearing after dismantling and prior installation shall be washed thoroughly. Babbitt oxidation may be removed with "Scotch Brite" or equivalent then the surface shall be burnished.

1.3.19 Remove momentarilly the bearing assembly platform and wash thoroughly the shaft journal bearing surface.

With honing stone remove all irregularities from the bearing journal. Hone in the direction of shaft rotation never across.

Polish with crocuscloth when completed with honing.

1.3.20 With reference to Dwg. 224D34723, ensure that the seal ring Pc. 5, in the inner oil sump is in good condition or replaced.

Wash the inner oil sump and wipe dry.

1.3.21 Reinstall the bearing assembly platform.

1.3.22 While handling the replacement guide bearing segments, special attention must be exercised to NOT damage the babbitt vertical corners at the bearing joints.

The corners should remain sharp to form unbroken surface when assembled.

1.3.23 Place the bearing halves in correct relation with reference to the intake side on the assembly platform around the shaft.

1.3.24 Verify the bearing joint seal ring that it is properly installed as per Dwg. 224F34721.

Bolt the bearing halves together then pre-stress the nuts Pc. 18, Dwg. 224F34721 to 210 lbft.

Ensure that the bearing bore joints are perfectly matched when assembled. Slight discrepancy may be corrected by scrapping the babbitt.

PART "B" MAINTENANCE RECOMMENDATIONS

1.3 (Cont'd).

1.3.25 Raise the assembled bearing from the platform and wash thoroughly.

Remove the platform.

1.3.26 Wash thoroughly the shaft journal and the inner oil sump.

NOTE: With reference to the 3/16" seal Pc. 30, Dwg. 224F34721.

The seal must have a perfect fit with the bearing inside bore otherwise the seal ring Pc. 5, Dwg. 224D34723 installed in the inner oil sump may leak at the bearing joints.

1.3.27 Carefully lower the assembled bearing and install. Do not lubricate the bearing or shaft at this time.

Immediately after installation check the bearing clearances.

The minimum design radial clearance is .005" and
the maximum design radial clearance is .008".

Providing bearing clearances is within specified range, remove the lifting equipment.

1.3.28 Center the guide bearing with respect to the spigot shims Dwg. 224C34789, Pc. 8, and secure in position with the 16, 3/4 nuts Pc. 4, Dwg. 224C34722.

Torque nuts to 156 ft.lbs. and lock with locking plates.

1.3.29 Take guide bearing clearance at 8 equally spaced points and record.

1.3.30 Clean cover plate Dwg. 224D34724, Pc. 1 and install. Orient with reference to intake side and bolt to the bearing.

1.3.31 Install felt packing Pc. 6, and the retaining ring Pc. 5. Tighten the retaining ring just enough so that the felt packing flattens and maintains approximately .010" clearance with the shaft.

1.3.32 With reference to the inner oil sump Dwg. 224D34723, check that the seal ring Pc. 5, is in place and well lubricated.

PART "B" MAINTENANCE RECOMMENDATIONS

1.3 (Con'd).

1.3.33 Align the slot in the sump flange see Dwg. 224D34723, Section "B-B", zone 4-c with the radial pin Pc. 32, which is located in the guide bearing base Dwg. 224F34721, Sheet 2, zone 4-c.

Lift the inner oil sump and insert into the bearing. Secure in place with the 4 radial capscrews Pc. 26, washer Pc. 27 as shown in Dwg. 224F34721, Sheet 1.

1.3.34 Fill the guide bearing with oil to normal oil level as shown in Dwg. 226D34642, in dimension "A". Check for oil leaks.

1.3.35 Reinstall the shaft coupling bolt nutguard.

1.3.36 Reinstall all bearing instrumentation, piping, conduits, etc., previously removed.

All instrument function shall be verified to ensure proper operation.

1.3.37 Return unit to ready state condition.

1.3.38 After bearing replacement, the unit shall be started with caution and at lower speed. The bearing temperature shall be monitored continuously for the first 30 minutes and after each speed increase until synchronous speed is reached.

1.3.39 When bearing temperature remains stable for one hour, the unit can be returned to service.

"PART B" MAINTENANCE RECOMMENDATIONS

1.4 SHAFT PACKING REPLACEMENT

Reference drawing: 224F34720.

1.4.1 In order to replace the shaft packing, the guide bearing and its instrumentation shall be removed as described in Para 1.3 of this manual.

It is not necessary to completely dismantle the guide bearing, however, ensure that upon lifting the bearing out of the housing, it is safely secured to avoid accident.

1.4.2 With reference to Dwg. 224F34720, split and remove the gland ring Pc. 5.

1.4.3 With packing extractor remove the first 2 packing rings Pc. 20, and spacers Pc. 21.

1.4.4 Remove the lantern ring halves Pc. 10, and then the remaining 2 packing and spacer rings.

1.4.5 Wash the shaft sleeve Pc. 2, and the stuffing box thoroughly.

1.4.6 Check the shaft sleeve condition. A good seal cannot possibly be obtained if the sleeve is scratched or worn.

Decide about repairs if necessary, change or recondition the sleeve or just hand dress with fine emery cloth.

1.4.7 Determine the length of the packing by wraping it around the shaft sleeve.

Cut the braid with sharp instrument to produce clean ends in 90 or 45 degrees cut.

1.4.8 Check spacers Pc. 21, width and trim if required.

1.4.9 Install the first two packing rings and spacers. Stagger the joints about 90^{o} apart.

The packing ring should fit snuggly into the stuffing box do NOT force them in and ensure that the joints is well made.

1.4.10 Install the lantern ring halves Pc. 10, and the remaining packing rings and spacers.

PART "B" MAINTENANCE RECOMMENDATIONS.

1.4 (Cont'd).

1.4.11 Clean the gland ring Pc. 5, and install. Ensure that it is oriented properly.

The gland ring should be more than finger tight only.

Overtightning of the gland ring will considerably shorten the life of the packing.

1.4.12 Reinstall the guide bearing with all instrumentation as described in Para 1.3.

1.4.13 The instruments operation shall be checked prior unit start up.

1.4.14 During the packing initial setting into the service observe closely its temperature. The cooling water supply should be adjusted higher than normal. Water discharge from the top of the packing should be clearly visible.

In the case the packing temperature reaches more then 100°F, stop the unit and restart only after the packing have sufficiently cooled of.

1.4.15 After some working time, the cooling water supply can be reduced, however, slight water discharge should be visible at all times. If necessary retighten the gland ring very gradually to not increase the packing temperature.

PART "B" MAINTENANCE RECOMMENDATIONS

1.5 WICKET GATE BREAKE LINK REPLACEMENT

Reference drawing: 224F34726.

1.5.1 In the event a solid foreign object should interfere with the operation of one or more wicket gates, the breake links are designed to breake before overloading any components thus preventing serious damage to the operating mechanism.

1.5.2 The unit shall be stopped for broken link replacement in the following manner:

a) Reduce unit load to zero
b) Disconnect from the line
c) Close the intake gates
d) With the intake gates at 75-80 percent close position initiate unit normal shutdown.

NOTE: Do NOT attempt to stop the unit with the intake gates open. There is enough water passing through the wicket gate with the broken link to maintain the unit at somewhat reduced speed.

1.5.3 In the case that the foreign object remains lodged in the way of wicket gates, the semi spiral case shall be dewatered and the object removed prior breake link replacement.

1.5.4 With the semi spiral casing depressurized, open the wicket gates approximately 5 percents then with reference to Dwg. 224F34726 loosen and remove both nuts Pc. 23, and washers Pc. 24.

1.5.5 Remove connecting link pin Pc. 15, from the gate lever and the broken part of the breake link.

1.5.6 Remove the other part of the link from the eccentric pin, Pc. 10.

1.5.7 Clean thoroughly the replacement breake link including the pins.

1.5.8 Lightly lubricate the link bushings with vaseline then install on the eccentric pin first.

Swing the link under the gate lever and insert connecting link pin Pc. 15.

PART "B MAINTENANCE RECOMMENDATIONS

1.5 (Cont'd).

1.5.9 Install both washther Pc. 24, and nuts Pc. 23. Prestress the eccentric pin nut Pc. 23, to 100 ft.lb. lubricated and the connecting link pin nut to 200 ft.lbs. lubricated.

1.5.10 Upon completion of the breake link replacement close the wicket gates.

In some cases where there is a doubt of the wicket gate proper closure, entering the spiral casing may be necessary for close inspection of the clearances.

1.5.11 Return unit to ready state condition and start when ready.

PART "B" MAINTENANCE RECOMMENDATIONS

1.6 WICKET GATE PACKING REPLACEMENT

Reference Drawing: 224F34726.

1.6.1 The unit shall be stopped and depressurized.

1.6.2 Remove the two nuts securing the packing gland Pc. 23, Dwg. 224F34726.

1.6.3 Raise the gland and secure inplace.

1.6.4 Remove the split ring spacer Pc. 17, then with packing extractor pull out the packing rings out of the packing box.

1.6.5 Clean the stuffing box and the wicket gate stem thoroughly.

1.6.6 Measure the new packing length and cut to suit with sharp instrument.

1.6.7 Lubricate the wicket gate stem with Molykote or equivalent grease then install the packing,four rings.

Stagger the packing joints approximately 90 degrees to each other.

1.6.8 Install the split ring space Pc. 17, and the gland. The gland nuts should be more than finger tight only.

Over tightening of the gland will not only shorten the life of the packing it may also damage the wicket gate sleeve.

PART "B" MAINTENANCE RECOMMENDATIONS

1.7 GATE LINKAGE ADJUSTMENT

Reference Drawings: 224F34725 and 334F34726.

1.7.1 If excessive wear occurs in the gate linkage it may be necessary to adjust one or all of the wicket gates to ensure proper closing.

This adjustment is accomplished by rotating the eccentric pin (Pc. 10, Dwg. 224F34726) in the operating ring (Dwg. 224F34725).

To proceed with the adjustment, dewater the unit. Place wicket gates in closed position, with operating ring in "closed" position exactly on index mark (see Drawing 224F34725, Zone i-f) and servomotors shall be depressurized.

It is probable that more than one eccentric pin will have to be adjusted in order to have the wicket gates equally closed.

Normally to maintain wicket gates evenly closed, all eccentric pins are readjusted equal amount to preserve the opening balance between the wicket gates.

When completed with the adjustment, ensure that all eccentric pins are prestressed as per Dwg. 224F34726.

Part "B" MAINTENANCE RECOMMENDATIONS

1.8 ALARM DEVICES

1.8.1 The alarm and shutdown devices for unit protection should be checked at regular intervals for satisfactory operation.

In addition to those listed below, the governing equipment devices listed in Woordward manual should also be verified.

a) Main guide bearing float switch high and low oil level alarms.

b) Main shaft seal lubricating water flow alarm. (Packing box).

c) Sump drain pumps high water level alarm.

d) Main guide bearing high temperature alarms.

PART "B" MAINTENANCE RECOMMENDATIONS

1.9 TURBINE DISMANTLING AND REASSEMBLY

1.9.1 Before dismantling and reassembling any of the turbine parts, the detail and assembly drawings of the parts in question, should be carefully studied and fully understood.

1.9.2 Instruction for assembly of the major turbine parts are provided in the "Field Erection Procedure", Dwg. 224A34702, 226A34603.

The procedure for minor dismantling and reassembly of other parts will be clear after study of the drawings.

1.9.3 Dismantling generally will be done in the reverse order to assembly. Dominion Engineering Works should be informed if complete unit dismantling is contemplated.

During reassembly, the following points should be noted.

a) All surfaces should be thoroughly cleaned and free from burrs.

b) All coupling bolts and dowel pins should be coated with white lead mixture or equivalent, before being installed.

c) The facing of the shaft and runner where they contact, should be given a light coat of boiled linseed oil for protection against rust.

d) Before replacing the head cover, it is most important to ensure that the wicket gate bushings are clean and lightly lubricated.

e) Care should be taken in the assembling of any two matting parts to ensure that the dowel holes are faire before inserting the dowels or fitted bolts. The dowels or fitted bolts should NOT be used for wedging the parts into line.

1.9.4 READ LEAD MIXTURE

A mixture of nine parts of read lead and one part of white lead and sufficient boiled linseed oil to produce the consistency of molasses.

1.9.5 WHITE LEAD MIXTURE

A mixture of white lead and light engine oil, of the consistency of paint, to use as a non-drying compound for fitted bolts, taper pins, etc. and other places where a non-corrosive removable joint is required.

PART "B" MAINTENANCE RECOMMENDATIONS

1.10 GOVERNOR EQUIPMENT

1.10.1 Refer to Woodward Manual.

1.10.2 The accumulator tank, sump tank and oil piping need very little maintenance apart from making sure that the oil in them is kept clean. All necessary precautions should be taken to ensure that the oil is maintained free of any foreign matter. Filters and strainers should be checked frequently and cleaned when necessary, the time intervals determined by the experience of the operating personnel.

1.11 AUXILIARY EQUIPMENT

1.11.1 For the maintenance recommendation regarding maintenance of the various auxiliary equipment, refer to the manufacturer's bulletins inside of this manual.

PART "B" MAINTENANCE RECOMMENDATIONS

1.12 NORMAL OPERATING DAILY CHECKS

a) Oil level in the turbine guide bearing oil sump.
b) Oil level in the governor accumulator and sump tank.
c) Packing box shaft seal water flow.
d) Turbine guide bearing temperature.
e) Head cover sump pumps operation.

1.13 NORMAL OPERATION WEEKLY CHECKS

a) Verify operation of governor oil pumps.
b) Inspect the air admission control valve operation.
c) Check governor and servomotor piping for oil leaks.
d) Check the spiral case and draft tube door for water leaks.
e) Clean governor oil fitlers. See Woodward instructions.
f) Check shaft seal water filter. Operating experience and the purity of inlet water will determine the necessary time requirement for the filter cleaning.
g) Check unit cleanliness and clean as needed.

1.14 NORMAL OPERATION MONTHLY CHECKS

a) Ensure that all alarms are functioning.
b) Verity setting of all pressure switches.
c) Check servomotors for oil leakage.
d) Check governors restoring system and adjust restoring cable as needed.
e) Check main shaft runout with dial indicator.
f) Check electrical wiring connections.

DOMINION ENGINEERING WORKS LIMITED
WELDING ENGINEERING STANDARD

DESCRIPTION	NUMBER	PAGE
GENERAL WELDING PROCEDURE AND UPGRADING FOR A TURBINE RUNNER OF 13-4 MATERIAL	W332-81	1 OF 3

1.15

INSTRUCTION

Scope

The purpose of the welding procedure is to set forth the requirements concerning welding in general and upgrading of the different components of the turbine runner.

Base Material

The base material is DEW Specification BB656-C1, similar to ASTM A-743 CA-6NM.

Base Material Preparation

The base material will be prepared by gouging and grinding. The preparation will be 100% magnetic particle procedure inspected to ensure freedom from cracking and any casting defects thought to be prejudicial to the weldment. It shall be cleaned and free from slag, oil, grease and any foreign material to ensure proper welding.

Repairs

Weld cavity preparation shall be in accordance with Page 4. (attached).

Cleaning and Defects

All slag or flux remaining on any bead of welding shall be removed before deposition the successive bead. Any defect appearing shall be removed by chipping, grinding or air carbon arc gouging before depositing the next bead.

Bracing and Temporary Welds

Temporary bracing and attachments shall be removed, exercising care that the base metal to which they are attached is not adversely affected. Projecting welds remaining after this operation shall be chipped and ground flush. Any tears in the base metal shall be welded and ground flush. All temporary welds shall be made with E308-16 electrodes.

Welding Process

The welding process will be primarily flux cored arc welding and supplemented with shielded metal arc.

Date de Révision Revision Date	Explication Explanation	Autorisation du Bureau Canadien de Soudure Canadian Welding Bureau Approval	Autres Autorités Compétentes Other Authorities Having Jurisdiction	Autorisation de l'Ingénieur Engineer's Approva
811127	New			
811214	Rev A, temporary welds added			

IL EST INTERDIT DE REPRODUIRE L'INFORMATION CI-DESSUS SANS L'AUTORISATION DES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE

DEW 10,797 (12/81)

INSTRUCTION

Filler Material

The filler materials shall be as follows:

Flux core arc welding	13-4 3/32 diameter certified wire, supplied by UTP
Shielded metal arc	13-4 certified electrode supplied by either Arcweld, Vanguard Steel or UTP
	AWS E308-16 for final touch up and temporary welds

Other suppliers' electrodes only to be used, subject to Welding Engineer's approval

Preheat

The preheat and interpass temperature for all operations shall be governed by the following.

Minimum preheat 200°F maximum interpass 500°F.

Preheat shall be applied in such a manner that the surfaces of the part on which weld metal is being deposited are at or above the specified minimum temperature for a minimum distance of three inches, both laterally and in advance of the welding. Operators must have correct temperature crayons to maintain these temperatures.

Welding Technique

Stringer bead shall be used. Efforts shall be made to limit the heat input by the use of welding currents at the lower end of the recommended ranges, but ensuring complete fusion.

Recommended Amperages	SMAW	FCAW
3/32	80-110	275-325
1/8	110-140	
5/32	140-175	
3/16	175/220	

Welding current shall be direct current reverse polarity.

The final layer of weld metal shall be deposited using the temper bead technique to minimize the hardness in the base metal heat affected zone.

Revision Date	Explanation	CWB Approval	Other Authorities Having Jurisdiction	Engineer's Approv.
811127	New			
811214	Rev A, temper welds added			

INGÉNIEUR · ENGINEER
23637
QUÉBEC

THE ABOVE INFORMATION MAY NOT BE REPRODUCED IN ANY FORM WITHOUT D.E.W. PERMISSION

Care and Storage of Filler Metals

Prior to their use, all shielded metal arc electrodes shall be removed from the package and placed in a holding oven within fifteen minutes after opening of the package.

The holding oven shall be maintained at 250°F=25°.

Electrodes shall be withdrawn from the holding oven as required and immediately placed in a heated electrode holding container, set at approximately 200°F. This container shall be kept within a few feet of the welding station.

Electrodes shall be withdrawn from the holding container and used within thirty minutes.

Wire spools on machines which will not be used for a period of three days will be removed, protected in plastic, and returned to stores.

Electrodes and wires with damaged coatings or those contaminated with grease, paint, dirt, etc., shall be destroyed.

Final Upgrading (Touch ups)

After complete fabrication and after final heat treatment operations are complete, minor touch up repairs using SMAW welding with AWS E308 electrodes is permitted.

Post Heat Treatment

Final heat treatment shall be stress relieve at 1000-1100°F generally after the components have been assembled and fully fabricated.

Non-Destructive Testing

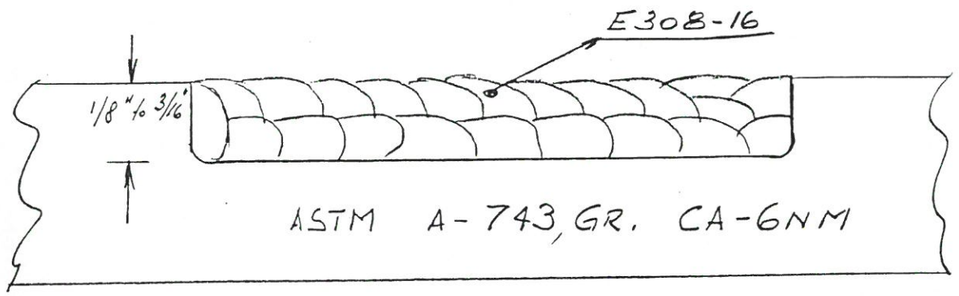
Upgrading weld deposits using 13/4 type filler materials shall be subject to 100% magnetic particle inspection. Upgrading weld deposits using 308 type filler material shall be subject to 100% dye penetrant inspection.

Date de Révision Revision Date	Explication Explanation	Autorisation du Bureau Canadien de Soudure Canadian Welding Bureau Approval	Autres Autorités Compétentes Other Authorities Having Jurisdiction	Autorisation de l'Ingénieur Engineer's Approval
811127	New			
811214	Rev A, temporary welds added			
840127	Revision B			

IL EST INTERDIT DE REPRODUIRE L'INFORMATION CI-DESSUS SANS L'AUTORISATION DES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE

TYPICAL OVERLAY REPAIR AREA
SECTION

N.T.S.



PART "B" MAINTENANCE RECOMMENDATIONS

1.16 KAPLAN RUNNER - DISMANTLING

Reference drawings: 226F34613, 226F34614, 226B34662, 226D34665 and 226F34686.

1.16.1 Secure two runner blades in position with come-a-long or weld a steel bar in between two of them.

1.16.2 With reference to Dwg. 226F34614, uncouple and remove the blades operating piston.

1.16.3 Check the cylinder walls and piston rings for scoring and other damage.

1.16.4 Ensure that the oil from the runner hub is drained then remove the runner from the turbine discharge ring.

1.16.5 Transfer the runner to the assembly area and turn over.

The runner estimated weight is 15,500 lbs. An auxiliary chain block suspended from the powerhouse crane will be required.

Do NOT rest the runner top end on rough surface use sheet of 3/4" plywood covered with plastic, to rest the runner on.

1.16.6 With reference to Dwg. 226F34614, remove the lower runner cone Pc. 145-2.

NOTE: Match mark all components before dismantling. Seals and o'rings shall be carefully inspected and replaced as necessary.

1.16.7 Carefully to not damage the spline sleeve Pc. 143-8, remove the upper runner cone Pc. 144-2, Dwg. 226F34614.

During the upper cone removal check the spline Pc. 143-8, for excessive wear. Do NOT forget to match mark the spline sleeve to the external spline (crosshead).

1.16.8 With reference to Dwg. 226F34614, remove from the socket head bolt Pc. 20, the lock wire Pc. 18.

1.16.9 Loosen all five bolts Pc. 20, and then suspend the cross head Pc. 143-2, from the crane.

1.16.10 Remove come-a-long or steel bar installed in Para. 1.16.1.

PART "B" MAINTENANCE RECOMMENDATIONS

1.16 (Cont'd).

1.16.11 Completely remove bolts Pc. 20, and carefully lift out the cross head in order to not damage the locating pins Pc. 17.

Ensure that the lug spacers Pc. 142-6, Dwg. 226F34686 are not mixed up.

1.16.12 With reference to Dwg. 226F34686, grind or cut off the tack weld from the lock pin Pc. 8, and remove.

1.16.13 With the special wrench Dwg. 226D34665, loosen all five blades spline nuts Pc. 6. Identify the nuts to theirs respective blade and remove.

1.16.14 With a pin extractor remove 8 taper pins Pc. 18, from the blade lever-trunnion assembly.

1.16.15 Block the blade lever and link assembly.

1.16.16 Place the blade in full flat position and with reference to Dwg. 226F34613, locate the 3, 1" plugged lifting holes. Remove the plugs and install 2 eyebolts and clamp Dwg. 226B34662. Or if more convenient, use "C" clamps instead to sling the blade. Blade estimated weight is 1075 lbs.

1.16.17 Lift the runner blade just enough to balance its weight, then slide it out of the hub. During the blade removal, secure the lever and link assembly and immediately after blade removal, lift the link assembly out of the runner hub.

Proceed with all blades in same manner.

1.16.18 With reference to Dwg. 226F34686, clean thoroughly the socket head screws Pc. 15, heads in order to be able to insert the hexagon wrench.

1.16é19 Remove the screws Pc. 15, from the hub then the gland segments Pc. 7.

Dismantle completely the remaining seal components.

1.16.20 Wash the whole runners hub and the blade trunnions with solvent then carry thorough inspection on all components.

1.16.21 Dismantle blades connecting links and inspect.

1.16.22 It is recommended that all seals, o'rings and packings be replaced.

PART "B" MAINTENANCE RECOMMENDATIONS

1.17 KAPLAN RUNNER - ASSEMBLY

Reference drawings: 226F34614, 226F34623, 226F34655, 226D34671, 226F34686.

1.17.1 Ensure that the hub interior and runner blades are clean.

1.17.2 Ensure that the trunnion bushing Pc. 11, Dwg. 226F34686 and the piston rod flanged bushing Pc. 143-7, in Dwg. 226F34614 are properly installed and the bore dimensions are in accordance to drawing.

1.17.3 Check that the oil groove edges in all bushings, thrust plates and thrust bearings are well rounded.

1.17.4 Verify the thrust plate Pc. 9, Dwg. 226F34614 fit against the runner hub, ensure that is feeler tight all around, and lubricate lightly with "Moly" type grease the outer surface.

1.17.5 Assemble the connecting link and blade levers as shown in Dwg. 226F34686, Zone g-2 and 3, incuding the lug Pc. 142-3.

1.17.5 Place No. 1 link-lever assembly into the runner hub, secure in approximate center of the trunnion bore and align the lever connecting pin to the horizontal center of the trunnion bore as shown in the Drawing 226F34686, Zone 3-4.

Lubricate the bore with grease.

1.17.7 Take No. 1 blade install ring Pc. 29, with the seal ring 30 and thrust bearing Pc. 10. Ensure that both components are placed in the correct direction consult with Dwg. 226F34686, Zone b-4 and 5.

1.17.8 Lubricate very lightly the thrust bearing and the trunnion bushing with "Moly" type grease.

Note: Heavy grease application will block the oil grooves thus preventing efficient free oil penetration and reducing the components lubrication resulting in damage to bearing surfaces.

1.17.9 Lift No. 1 blade and balance to maintain the trunnion in levelled position then insert carefully into the runner hub.

The blade lever may have to be slightly repositioned to suit the blade trunnion.

PART "B" MAINTENANCE RECOMMENDATIONS

1.17 (Cont'd)

1.17.10 Align the dowel pin half holes in the blade trunnion with the half holes in the lever then insert the pins lighly lubricate. Install only snuggly tight at this time.

1.17.11 Lubricate the spline nut and the blade trunnion threads. Install nut and snug tight.

Block the blade with suitable blocks and hardwood wedges to prevent movement and blade sag.

Ensure that the blade is tight against the thrust bearing Pc. 10, then check the clearance between the lever and thrust plate. The clearance should be between .005" to .007" all around.

1.17.12 Remove the spline nut and firmly drive in the 8 taper pins Pc. 18, installed in Para 1.17.10.

1.17.13 Reinstall the spline nut and prestress with the special wrench Dwg. 226F34665.

Torque the screw Pc. 37 to 350 lb.ft., lubricated as instructed in the drawing zone f-3.

Recheck blade clearances as per Para. 1.17.11.

1.17.14 Install lock pin Pc. 8, and tack weld to the blade lever as shown in Dwg. 226F34686.

In a case that the 3/8" pin hole in the lever is not aligned with the nut spline, you may drill new hole into the lever approx. 1" from the old one.

Drill 3/8" dia x 3/4" deep.

1.17.15 With reference to Dwg. 226F34686, install the blade trunnion seal as shown in the drawing.

Lubricate the seal prior immediate installation.

PART "B" MAINTENANCE RECOMMENDATIONS

1.17 (Cont'd)

1.17.16 Install the seal gland segments. Insert spring washers Pc. 40, and socket head screws Pc. 15. Prestress the screws to 15 lbs.ft.

It may be necessary to move the blade in case some screws are behind the blade and not accessible.

In case that some screw head is protruding from the gland, it must be ground flush with the gland surface.

1.17.17 After completion with the blade seal installation, place all blades in OPEN position and block.

1.17.18 Thoroughly clean the cross head Pc. 143-2, Dwg. 226F34614, then suspend from the crane and place above the runner hub.

1.17.19 Ensure that the seal Pc. 143-14 is installed in the bushing Pc. 143-7.

1.17.20 Lubricate lightly the bushing bore Pc. 143-7, and the cross head operating rod.

1.17.21 Install lug spacer Pc. 142-6, Dwg. 226F34686. Note that the spacers shall be installed exactly in same location as previously and must NOT be interchanged under no circumstances.

Align the cross head and connecting link [illegible] position locating pin Pc. 17, Dwg. 226F34614, install washer Pc. 21, and socket head bolt Pc. 20, snug tight.

When completed with the assembly of all 5 arms, prestress bolts Pc. 20, to 600 lb.ft (lubricated).

1.17.22 With adhesive install seal ring Pc. 144-5, into the runner uper cone Pc. 144-2, Dwg. 226F34614.

1.17.23 Turn over the runner cone align the internal spline Pc. 143-8, with the external one on the cross head and install the cone with correct orientation to the dowel pins Pc. 144-6 and match mark.

Install locking plates Pc. 15, and nuts Pc. 16. Prestress nuts Pc. 16, to 100 lb.ft. Bent locking plates Pc. 15, as shown in drawing to lock nuts Pc. 16.

PART "B" MAINTENANCE RECOMMENDATIONS

1.17 (Cont'd).

1.17.24 Install seal ring Pc. 145-11, into the runner lower cone Pc. 145-2, as shown in Dwg. 226F34614, then bolt the lower cone to the upper one. Prestress bolts Pc. 145-5 to 45 lb.ft (lubricated).

1.17.25 Place the blades in fully closed (flat) position and secure in same manner as in Para. 1.16.1 during runner dismantling.

1.17.26 Turn the assembled runner over and install into the discharge ring supporting it on the support blocks, see Dwg. 226D34671.

1.17.27

PART "B" MAINTENANCE RECOMMENDATIONS

1.18 (Cont'd)

1.18.13 When completed with the packing replacement, refill the runner hub with oil.

This maybe done through the 1 1/4" ball valve in the runner cone or through the oil head piping.

PART "C" OPERATING INSTRUCTIONS

1. TURBINE

1.1 PROCEDURE BEFORE START-UP

The following are checks to be made before starting the unit for the first time or after a major overhaul.

They do not refer to assembly checks that should be made during erection.

1.1.1 BEFORE FILLING THE CASING

1.1.2 Clear the turbine pit of any object that could fall into and plug the drain or foul the wicket gate operating mechanism.

1.1.3 Check breake links condition.

1.1.4 Check that the casing is clean and free of anything that could foul the wicket gates or the runner blades.

1.1.5 Ensure that the draft tube is cleaned thoroughly right up to the tailgate and loose material removed.

1.1.6 Check that the semi-spiral case and draft tube mandoor are shut tight.

1.1.7 Ensure that the casing drain valve is clean and shut.

2. GOVERNING EQUIPMENT

2.1 BEFORE WATERING THE DRAFT TUBE AND CASING

2.1.1 Check that the oil level in the accumulator tank is at normal operating level.

2.1.2 Ensure that the oil pressure in the accumulator tank is normal.

2.1.3 Check oil level in the sump tank.

2.1.4 Open and close wicket gates several times to ensure that no air is trapped in the servomotors or piping.

PART "C" OPERATING INSTRUCTIONS

2.1 BEFORE WATERING THE DRAFT TUBE AND CASING (Cont'd).

2.1.5 Check that the timing for the opening and closing stroke of the wicket gates is correct.

2.1.6 Make sure that the wicket gates are closed with the squeeze on, and the servomotor locking device in place, if available.

2.1.7 Ensure that the oil in the turbine guide bearing is at normal level and the oil level indicator set at "FULL UNIT STOPPED".

2.1.8 Head cover sump pumps energized.

3. TURBINE.

3.1 WATERING THE TURBINE

3.1.1 The draft tube shall be filled first. The initial filling shall be done slowly, and during this period, the whole turbine will be continuously under observation.

3.1.2 With water stabilized at tailwater elevation, inspect the turbine thoroughly and if all normal, the draft tube gates may be removed.

3.1.3 If tailwater elevation is above the shaft packing box, check the seal assembly for water leaks. Some leakage through the packing may be detected. This is normal condition.

3.1.4 If the unit has been shutdown for a week or longer, it is adviseable to pour about quart of clean bearing oil around the top of the turbine guide bearing and let it seep into the bearing clearance.

3.1.5 Providing all is satisfactory, a slow spiral case pressurization may commence. Observe the unit closely, especially the turbine pit.

NOTE: The unit may creep (slow rotation) at this time, take all necessary safety precautions.

PART "C" OPERATING INSTRUCTIONS.

3.1 WATERING THE TURBINE (Cont'd).

3.1.6 In order to not inject dirty water into the main shaft packing, open the water supply line closest possible to the shaft packing box. Open the water supply valve and discharge water through the piping until clean.

Reconnect the supply pipe to the packing box and pressurize the seal 2 to 3 PSI higher than the indicated pressure below the seal. Refer to duplex pressure gauge, Pc. 6, Dwg. 224F34738 or 226F34631 for Kaplan.

3.1.7 Adjust the seal water flow alarm to actuate just below present water flow requirement.

The water pressure setting will have to be readjusted during unit operational testing, however, the flow alarm remains at present setting.

3.1.8 Verify the operation of both head cover sump pumps and adjust, as necessary, the water level float switch.

3.1.9 Check all water supply and drain piping for leaks and correct if so required.

4. TURBINE

4.1 CHECKS PRIOR TURBINE STARTING

4.1.1 Adjust the packing box water flow.

4.1.2 Both head cover sump pumps must be energized.

4.1.3 Temperature indicators are calibrated.

4.1.4 Ensure that the turbine air vent system is functional and the valve inlet is free from obstruction.

4.1.5 The control annunciator board clear as far as turbine is concern.

PART "C" OPERATING INSTRUCTIONS

4.1 CHECKS PRIOR TURBINE STARTING (Cont'd)

4.1.6 Communication system organized.

4.1.7 Initial unit start RPM determined.

4.1.8 Test crew briefed and ready at their respective stations.

5. TURBINE.

5.1 START-UP PROCEDURE

5.1.1 When all equipment has been checked and is ready for start-up, the unit shall be started in accordance with governor, turbine and generator manufacturer representatives instructions. (Commissioning time only).

5.1.2 The intake gates are usually open approximately 25% at this time in case an emergency closing is necessary.

5.1.3 Place dial indicator on the guide bearing cover plate and against the main shaft in order to be able to observe the shaft runout.

Remove servomotor locking device.

5.1.4 The unit shall be started on manual control. Refer to Woodwards manual for details.

5.1.5 Start the unit by opening the wicket gates quickly approximately 5 to 10% gate opening. As the unit begins to rotate, immediately close the wicket gates with the governor control and listen for any unusual noises indicating interferences between any of the rotating parts.

5.1.6 Due to lack of braking equipment, the unit many creep. In this case, the intake gates should be closed.

5.1.7 Providing that the initial start has been successful, the unit may be restarted.

Open the wicket gates approximately 30% and as the unit speed rises reduce the wicket gate opening until the unit speed stabilises. Open the wicket gates little at a time and maintain speed control at all times until the desired speed is reaches.

PART "C" OPERATING INSTRUCTIONS

5.1 START-UP PROCEDURE (Cont'd)

5.1.8 The temperature of the guide bearing shall be monitored constantly until rated speed is reached and at operator discretion thereafter.

Guide bearing operating temperature should settle between 55° and 70°C.

5.1.9 Shaft runout and generator balance shall be closely observed and the generator balance adjusted as necessary.

5.1.10 Shaft seal water flow shall be adjusted as needed.

5.1.11 Guide bearing oil level must be regularly observed in order to detect oil leakage early.

5.1.12 Observe the operation of the head cover sump pumps.

5.1.13 When the turbine bearing temperature stabilizes, which means that the temperature has levelled and becomes constant for period of more than one hour, adjust the bearing oil level indicator to "FULL UNIT RUNNING". See Drawing 226D34642, Zone e-5.

PART "C" OPERATING INSTRUCTIONS

6. CHECKS DURING INITIAL OPERATION

6.1.1 The following should be carried out at least once per day during the turbine initial operation.

6.1.2 Check the turbine guide bearing oil level.

6.1.3 Check the water flow to the shaft packing box.

6.1.4 Check the packing box water strainer and clean as necessary.

6.1.5 Check the servomotor piston rod packing for oil leaks.

6.1.6 Ensure that the head cover sump pumps are functionning properly.

6.1.7 Check the governing equipment as per Woodwared instruction manual.

7. TURBINE.

7.1 SHUTDOWN PROCEDURE

7.1.1 Shut the unit down in accordance with the generator and governor manufacturers instructions.

In a case that the unit creeps, close the intake gates.

PART D

SUMMARY OF CATALOGS AND ENCLOSED DRAWINGS

DRAWINGS

SECTION	DESCRIPTION	ORIGIN	I.D.
A	Sectional Elevation	DEW	224F34700
A	Sectional Elevation	DEW	224F34701
2	Sump pump level control - U-1 & 2	DEW	224F34733
3	Coupling bolt for runner end	DEW	224C34729
3	Coupling ends for gen. & turbine shaft	DEW	224C34717
3	Packing box assembly	DEW	224C34706
3	Packing box	DEW	224F34720
3	Packing box piping	DEW	224F34738
4	Oil level indicator & float switch	DEW	226D34642
5	Assembly of links and levers	DEW	224F34726
2A	Sump pump and level control	DEW	226F34638
3A	Runner hub assembly	DEW	226F34614
3A	Runner blade and lever assembly	DEW	226F34686
4A	Packing box	DEW	226D34620
4A	Packing box piping	DEW	226F34631
4A	Coupling ends for gen. & turbine shaft	DEW	226C34617
6A	Assembly of links and levers	DEW	226F34626
7A	Oil head assembly	DEW	226F34644
7A	Oil head pipes	DEW	226F34643
9	Lifting device for runner and shaft	DEW	224C34751
9	Eyebolt	DEW	224B34752
9	Runner and shaft support fixture	DEW	224F34758
9	Runner support and top bracket assy.	DEW	224D34757
9	Lifting device for runner and shaft	DEW	226C34653
9	Pipe holder	DEW	226C34660
9	Runner support & stop bracket assy.	DEW	226D34671
9	Turbine wiring diagram U-3	DEW	226C34635
9	Electrical conduit in turbine pit	DEW	224F34736
9	Governor piping	DEW	226F34640
9	Governor piping	DEW	224F34740
9	Instrument panel	DEW	226F34607
9	Turbine wiring diagram U-1 & 2	DEW	224C34735
9	Accessory connections	C.G.E.	224D34767

PART D

SUMMARY OF CATALOGS AND ENCLOSED DRAWINGS

CATALOGS

SECTION	MANUFACTURER	DESCRIPTION	I.D.
2	Higgison Equipment	Motor and Pump	237577-77
2	C.F. Warrick Co.	Level controls	B3764W, B3002D & B3003D.
4	Minco	R.t.d.'s	RTD-2
4	H.O. Trerice	Temperature controls	L84100
4	Magnetrol	Liquid level	C44-604.4
2A	Pylon	Inverter	G-22
4A	H.O. Trerice	Pressure regulator	
4A	Airpel	Dual filter	
7A	H.O. Trerice	Pressure gauge	

VOLUME 2

PART -10	Installation of Cabinet actuator equipment	07070C
	Solennoid actuated auxiliary dashpot bypass	09019A
	Governor transmitters/switchboard receivers	09021A
	Tachometer and speed switch assembly	09031B
	Screw type pumping unit	10008E
	Mounting and alignment of horiz. pumps & motors	10012B
	GS Actuator	14043C
	Oils for use in hydraulic turbine governors	25056A
	Hand pump operating instructions	EN20081
	Allen Bradley Pressure Controls	836T
	Bodine motor installation, use, maintenance	D/C253969
	Deleval-Pyramid pump information	G3D-6 (R-2)
	Deleval-Pyramid Pump instruction manual	CA-1
	GE Cr9503 Solenoid	GEH-119T
	GE Magnetic starters	GEH4796B
	GE CR9503 Solenoid connections	GEM-340F
	GE CR9440 Limit switch	GEA8394A
	Leeson Motor	IB(NA)64118B(8001)
	Magnetrol switch mechanisms	42-683
	Magnetrol level controls	45-610.4
	Magnetrol liquid level controls	46-620.2
	Skinner valve	D14.5.1

PART D

SUMMARY OF CATALOGS AND ENCLOSED DRAWINGS

VOLUME 2

10	Elementary & Wiring Diagram	Woodward	9973-332
	GS Actuator arrangement	Woodward	9981-547
	Pumping unit arrangement	Woodward	9981-553
	Outside gate restoring arrangement	Woodward	9981-617
10	H-3312 Elementry diagram	Woodward	9970-616
	H-3312 Wiring diagram	Woodward	9973-348
	H-3312 GS Actuator arrangement	Woodward	9981-548
	Pumping unit arrangement, H-3312	Woodward	9981-573
	Electronic 3D Cam	Woodward	3D-20
	3D Cam	Woodward	09035
10	Slosyn	Woodward	SE-117715
	7.7-54V SPCT Pilot Relay board	Woodward	5430-400
	23-150V DPDT Pilot Relay board	Woodward	5431-128
	CR104P Blade control switch assembly	Woodward	5440-100
	AC-DC or DC-DC Power supply	Woodward	5450-084
	Control standard	Woodward	141938J
	Mechanical tachometer adapter assy	Woodward	5119-030
	Dual strainer assembly	Woodward	5210-530
	3.000 Float valve assembly	Woodward	5240-564
	CR104P Motor Heater switch assy	Woodward	5440-148
	Speed adjust limit switch assy	Woodward	5831-024
	Complete and partial shutdown assy	Woodward	5851-517
	Solenoid operated unloader assy	Woodward	6976-442
	Packing and gaskets kit	Woodward	8935-080

LIST OF DRAWINGS
JACKSON BLUFF
PROPELLER TURBINE
UNITS 1 AND 2
CONTRACT: 244-900400

224F34700	Sectional elevation - Unit #2
224F34701	Sectional elevation - Unit #1
224A34702	Erection procedure
224F34703	Head cover - Unit #2
224D34704	Partial draft tube liner
224B34705	Shipping diagram for discharge ring
224C34706	Packing box - Unit # 1
224A34707	Painting head cover - Unit #2
224D34708	Bottom ring and discharge ring fabrication
224F34709	Bottom ring and discharge ring machining
224D34710	Wicket gate - machined
224F34711	Head cover - Unit #2
224D34712	Wicket gate - fabrication
224A34713	Runner balancing
224F34714	Runner
224F34715	Nut guard, coupling stud, etc.
224D34716	Runner cone
224C34717	Coupling ends of generator/turbine shafts
224C34718	Shaft forging
224D34719	Turbine shaft
224C34720	Packing box - Unit #2
224F34721	Bearing
224C34722	Adapter ring for guide bearing
224D34723	Inner oil sump
224D34724	Cover plate
224F34725	Gate operating ring
224F34726	Links and levers assembly
224F34727	Links and levers
224C34728	Spacer ring, thrust washer, wearing ring for links and levers
224C34729	Coupling bolt - runner end
224C34730	Wicket gate sleeves
224D34731	Bushings for bottom ring and head cover
224A34732	Instr. for assembly of plastic bushing
224F34733	Sump pump and level control
224C34734	Pipes and supports for s. p. and level control
224C34735	Turbine wiring diagram
224F34736	Electrical conduit for turbine accessories
224F34738	Packing box piping
224F34739	Packing box housing

/2.....

List of drawings

224F34740	Governor piping
224B34741	Gland for head cover
224F34742	Blade position and thickness check
224D34743	Runner surface finish
224F34744	Blade contour template set-up
224D34745	Inverter-support
224A34747	Purchase specification for runner cone
224C34751	Lifting device
224B34752	Eye bolt
224D34757	Runner support and stop bracket assembly
224F34758	Shaft and runner support fixture
224D34767	Diagram of accessory connections
224D34768	Outline of synchronous generator
224C34769	Shaft profile
224D34770	Arrangement - G.S. actuator (W.G. 9981-547)
224D34771	Arrangement - Pumping Unit (W.G. 9981-553)
224D34772	Diagram - Elementary and wiring (W.G. 9973-332) 2 sheets
224D34773	Arrangement outside gate restoring
224A34788	Painting for head cover - Unit #1
224C34789	Guide bearing spigot blocks
224C34790	Grooves in bearing
224A34791	Purchase specification for main guide bearing
224A34792	Painting of main guide bearing
224A34793	Purchase specification for packing box.

E

LIST OF DRAWING
JACKSON BLUFF
KAPLAN TURBINE
UNIT 3
CONTRACT: 246-900200

226F34601	Elevation
226A34602	Surf. & preparation painting
226A34603	Erection procedure
226D34604	Draft tube liner
226F34605	Discharge ring
226A34606	Runner hub test procedure
226F34607	Turbine instrument panel and piping
226F34608	Inner head cover
226F34609	Bottom ring
226D34610	Wicket gate machining
226D34611	Head cover
226F34612	Lever, nut
226F34613	Runner blade
226F34614	Runner hub assembly
226F34615	Runner hub machined
226F34616	Upper and lower runner cone
226C34617	Coupling ends - Generator and Turbine
226C34618	Shaft forging
226F34619	Shaft machined
226D34620	Packing box
226F34621	Main guide bearing
226F34622	Cross head
226F34623	Piston, bushing, spline sleeve
226D34624	Cover plate
226F34625	Gate operating ring
226F34626	Links and levers
226A34627	Painting Gate operating ring
226C34628	Spacer ring, wearing plate thrust washer for links and levers
226B34629	Panel enclosure - ordering drawing
226B34630	Supports for packing box p.
226F34631	Packing box piping
226F34632	Sump pump and level control
226C34633	Supports for S.P. & L.C.
226B34634	Nameplates
226C34635	Turbine wiring diagram
226D34636	Bracket shaft for compensator
226D34637	Instrument panel
226C34638	Cover
226D34639	Piezometer details

/2.....

List of drawings

226F34640	Governor piping
226C34641	Flange, bushing for governor piping
226D34642	Bearing oil level indicator
226F34643	Oil head piping assembly
226F34644	Oil head assembly
226F34645	Oil head body (top)
226F34646	Oil head body (middle)
226F34647	Oil head body (bottom)
226F34648	Oil head details
226F34649	Oil head details
226C34650	Bushings (for oil head)
226C34651	Insulating washer and bushing (for oil head)
226B34652	Plexiglas window (for oil head)
226C34653	Lifting device for R & Shaft
226D34654	Runner balancing
226C34655	Oil head pipe detail
226C34656	Oil head pipe detail
226C34657	Oil head pipe detail
226D34658	Oil head pipe detail
226C34659	Oil head pipe detail
226C34660	Pipe holder
226B34661	Shipping diagram for discharge ring
226B34662	Clamp for handling blade
226C34663	Runner hub details
200B34664	Locking plate
226D34665	Wrench for trunnion nut
226A34666	Head cover surface preparation and painting
226D34667	Bushings (head cover, bottom ring)
226C34668	Bottom ring fabrication
226C34669	Runner hub test diagram
226D34670	Nut guard, coupling bolt, etc
226D34671	Runner support and stop bracket assembly
226D34672	Runner support and stop bracket (detail)
226A34673	Screw plug
226C34674	Wicket gate sleeve
226A34675	Wicket gate painting drawing
226D34676	Facing plate and linvers
226A34677	Patch bold
226D34678	Wicket gate fabrication
226D34679	Shaft sleeve
226A34680	Inspection cover for main guide bearing
226A34681	Purchase specification for inner head cover
226C34682	Wearing ring liner

/3.....

List of drawing

226A34683	Stud
226C34684	Seal plates (for hub press test)
226D34685	Linkage for runner blade
226F34686	Runner blade and lever assembly
226B34687	Locking plate 1-hole
226B34688	Order drawing for thrust bearing for runner blade
226F34689	Bushing, thrust bearing for runner blade
226C34690	Grooves in bearing
226C34691	Seal ring
226A34692	Painting runner hub
226D34693	Inner oil sump
226F34694	Blade position and thickness check
226F34695	Blade contour check
226D34696	Blade surface finish
200B34698	Locking plate
226A34699	Purchase specification for upper and lower runner cone

F

ERECTION PROCEDURE

FOR

JACKSON BLUFF TURBINE

UNIT 1 & 2

The following procedure is furnished to assist the erection contractor in the installation of propeller type turbine.

It outlines a sequence of erection of the parts appropriate to the Jackson Bluff Turbines.

It is not intended to be an exhaustive procedure or substitute for the advice of the turbine manufacturer field representative .

Nothing in this procedure should be construed as relieving the erection contractor from the responsibility for the proper installation of all turbine parts.

CONT. 244-900400

REVISION	A												REF.

DIM. EN POUCES/ DIM. IN INCHES
ÉCHELLE/SCALE =12
DES. DR. F.J. VER. CHK.
PROJ. PASS
APPR.
DATE 84/09/05
PROJECTION

LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA
DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA

ERECTION PROCEDURE

HYDRAULIC | FEUILLE SHEET 1 DE OF 24 | REV.

2 2 4 A 3 4 7 0 2

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS LEUR AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

MICROFILMED

INDEX

1. Stay Ring
2. Discharge Ring - Draft Tube Liner
3. Bottom Ring
4. Wicket Gates
5. Runner
6. Head Cover Assembly
7. Shaft to Runner Coupling
8. Shaft Sleeve
9. Head Cover Installation
10. Gate Operating Ring and Associated Mechanism
11. Uncoupled Rotational Checks
12. Shaft Coupling and Alignment Checks
13. Shaft Seal Packing Installation
14. Guide Bearing and Inner Oil Sump Installation.

REVISION	A												REF.

DIM. EN POUCES / DIM. IN INCHES		LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA	
ÉCHELLE/SCALE =12			
DES. DR. F.J.	VER. CHK.		
PROJ. PASS		HYDRAULIC	FEUILLE SHEET 2 DE OF 24
APPR.	PROJECTION		REV.
DATE 84/09/05		ERECTION PROCEDURE	2 2 4 A 3 4 7 0 2

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS LEUR AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

MICROFILMED

1. STAY RING

1.1 Clean the upper stay ring flange and the bottom ring support thoroughly.

1.2 Take level readings of both surfaces and locate the lowest points .

1.3 With pin gauge determine the distance from the upper flange to the bottom ring support surface.

1.4 Grind the stay ring upper flange level within .010" from the highest to the lowest point.

1.5 The bottom ring support shall be ground level within .010" and the radial level shall be maintained within .005".

1.6 During the stay ring grinding process, consideration with respect to the distance between the two surfaces must be taken and maintained as per drawing specification.

1.7 The following measurements shall be recorded in QCIR-I - 15146

a) Level of the stay ring upper flange.

b) The level of the bottom ring support surface.

c) The radial level of the bottom ring support surface.

d) The roundness of the upper flange inner bore.

e) The distance between the upper and lower surfaces.

Wash thoroughly the 64, 1-1/4" threaded holes in the stay ring upper flange then install all studs with "Loctite".

REVISION												REF.
	A											

DIM. EN POUCES/ DIM. IN INCHES	LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA		
ÉCHELLE/SCALE =12			
DES. DR. F. J. / VER. CHK.			
PROJ. PASS /			
APPR. / PROJECTION			
DATE 84/09/05	ERECTION PROCEDURE	HYDRAULIC FEUILLE/SHEET 3 DE/OF 24 2 2 4 A 3 4 7 0 2	REV.

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS LEUR AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

MICROFILMED

2. DISCHARGE RING - DRAFT TUBE LINER

2.1 Place short straight edge across the bottom ring support surface and from the straight edge base measure down 35 5/8".

Scribe circumferential line on the inner side of the draft tube liner. It is important to maintain the scribed line at the same elevation all around. Highlite the scribed line with center punch marks.

2.2 Cut the liner in any most convenient manner (air-arc gouging, etc.). However, ensure that the center punch marks remain visible after completion.

2.3 Grind the draft tube liner edge and prepare for welding.

2.4 Install the discharge ring dwg. 224F34709 Pc.6 on the foundation ring.

2.5 Adjust the discharge ring elevation flush with the bottom ring support surface and secure.

2.6 Establish plumb centerline and center to the stay ring upper flange bolt circle within 1/32".

2.7 Check the discharge ring roundness and center to the plumb wire. Adjust as necessary to maintain both within .010".

2.8 To retain the discharge ring within specified tolerances, it is recommended to install small field made steel blocks between the top of the discharge ring and the stay ring bottom ring support. The blocks should be tight fitted between the two and welded to the discharge ring.

2.9 With reference to the 20 holes in the discharge ring lower end by using them as a jig, drill and tap the foundation ring as shown in the drawing 224F34709.

2.10 Insert the 20, 1"-8UNC studs Pc.24 tight into the foundation ring. Cut the studs approximately 1/16" longer than the discharge ring inside bore.

REVISION	A												REF.

DIM. EN POUCES/ DIM. IN INCHES
ÉCHELLE/SCALE =12
DES. DR. F. J. VER. CHK.
PROJ. PASS
APPR.
PROJECTION
DATE 84/09/05

LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA
DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA

ERECTION PROCEDURE

Hydraulic | FEUILLE SHEET 4 DE OF 24 | REV.

2 2 4 A 3 4 7 0 2

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS LEUR AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.
MICROFILMED

2.11 Weld the studs to the discharge ring with care to ensure that the weld will not disturb the discharge ring alignment.

Recheck the discharge ring alignment & correct if necessary.

2.12 Grind the studs Pc.24 and weld flush with the discharge ring inside surface.

2.13 Fit the stainless steel lining dwg. 224D34704 Pc's.2 to 6 in between the draft tube liner and the discharge ring. Trim plates as necessary around the draft tube manhole (see also note below).

Weld the new lining to the draft tube liner first and only after the plate returned to the ambient temperature, the welding between the liner and discharge ring may proceed.

2.14 Grind all welds smooth with surrounding area & blend with profile. Do not undercut.

2.15 The discharge ring and draft tube liner may be grouted now.

When completed, ensure that all grout openings shall be sealed with plugs Pc.30, dwg. 224F34709 and ground smooth & flush.

NOTE: The installation of the draft tube manhole frame with cover and the pockets for the maintenance platform is NOT part of DEW supply.

REVISION	A											REF.

DIM. EN POUCES/ DIM. IN INCHES
ÉCHELLE/SCALE =12
DES. DR. F. J. | VER. CHK.
PROJ. PASS | |
APPR. | PROJECTION
DATE 6/10/65

LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA
DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA

ERECTION PROCEDURE

HYDRAULIC | FEUILLE SHEET 5 DE OF 24 | REV.

2 2 4 A 3 4 7 0 2

3. BOTTOM RING

3.1 Establish intake centerline on the stay ring upper flange and on the top of the lower shroud. Highlite the centerline with center punch marks .

3.2 Place suitable wooden blocks on top of the stay ring bottom ring support.

3.3 Clean the bottom ring halves dwg. 224F34709 Pc. 3 & 4 and the joints thoroughly. Protect the plastic bushings Pc. 17 with pieces of plywood properly secured.

3.4 Place the bottom ring halves on the blocking; apply light coat of red lead compound or equivalent on one side of the joint only.

Pull the joints together and secure with the 1-1/4" 7UNC nuts Pc.21. Ensure that the bottom ring sections are perfectly aligned with respect to each other. Check that the bottom ring top surface and the inner bore do not have any steps, then torque the nuts to 750 ft.lbs. (lubricated).

Tack weld nuts Pc.21 to bottom ring to lock. Paint the whole area including nuts and studs with red lead paint

3.8 To control bottom ring during the alignment process use steel wedges or shims between the bottom ring outer diameter and the stay ring shroud inner bore.

3.9 With 1-1/16" drill, spot mark the 18 bottom ri[redacted]

4. WICKET GATES

4.1 Clean the wicket gates, Dwg. 224D34710, upper and lower stems and the gate machined surfaces to ensure that all burrs are removed.

4.2 Clean bottom ring, Dwg. 224F34709, including the bushings Pc.17.

4.3 Install the o'rings Pc.18, into the bottom ring bushings, dwg. 224F34709.

4.4 All wicket gates are numbered on the upper stem top surface and must be installed corresponding to the numbers stamped at each bushing on the bottom ring.

4.5 Immediately prior to wicket gate installation, apply light coat of vaseline on the lower stem then insert carefully the gate stem into the bushing.

NOTE: Exercise caution during the wicket gate installation. The plastic bushing is susceptible to chipping. Damaged bushing shall be replaced.

Do not force the wicket gate into the bushings.

4.6 Place the installed wicket gates in approximate closed position.

REVISION	A												REF.

DIM. EN POUCES / DIM. IN INCHES	LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA		
ÉCHELLE/SCALE =12			
DES. DR. F.J. / VER. CHK.			
PROJ. ASS. /			
APPR. / PROJECTION		HYDRAULIC	FEUILLE SHEET 9 DE OF 24
DATE 84/09/05	ERECTION PROCEDURE	2 2 4 A 3 4 7 0 2	REV.

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS LEUR AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.
MICROFILMED

5. RUNNER

5.1 Clean the runner cone, Pc.1 dwg. 224C34716, all machined surfaces including the 12, 1" studs Pc.3. Place the cone in a convenient location to suit cone to runner assembly.

5.2 Install 4, 1-1/4" 7UNC eyebolts into the top of the runner , dwg. 224F34714.

5.3 Raise the runner and clean all machined surface at the bottom.

5.4 Align the runner with the cone, dwg. 224C34716. Lower the runner to within 3/8" of the cone. Do NOT rest the runner on the cone at any time !

5.5 Install 12, 1" nuts Pc.4 with the locking plates Pc.5 onto the cone studs then pull up the runner cone until tight against the runner.

6. HEAD COVER ASSEMBLY

6.1 Clean the wicket gate top and intermediate bushings, Pcs. 15 &16 in the head cover dwg. 224F34711 including the packing box bore.

6.2 Install all packing glands Pc.23 without the packings.

6.3 Clean thoroughly the head cover radial joints and the machined outer flange.

6.4 Install section of the head cover into the turbine pit. Rotate the head cover section so that the wicket gate stem will be halfway between the bushings.

Place & secure on top of the wicket gate stems piece of 6" x 6" x 1/2" thick plywood. Rest the head cover on top of the wicket gates stems.

6.5 Prior to bolting the head cover sections together, apply small bead of G.E. Silastic sealing compound or equivalent over the entire length of the joint.

6.6 Pull the head cover sections together, align with relation to each other then bolt tight. Pre-stress bolts to 200 ft. lbs. (lubricated).

6.7 Ensure that the head cover is centered to the runner within 1/4" on diameter after the head cover assembly.

6.8 With reference to dwg. 224F34720, clean adaptor ring Pc. 11 and head cover base.

6.9 Install studs, Pc.18, with "Loctite". Ensure that the tapped holes in the head cover are thoroughly cleaned with solvent and blown with compressed air prior to studs installation.

6.10 Install adaptor ring and secure in place with nuts Pc.19. Prestress studs to 55 ft. lbs. and tack weld nuts to adaptor ring to lock.

6.11 Clean the adaptor ring for the guide bearing, dwg. 224C34722.

6.12 Clean the guide bearing flange in the head cover.

6.13 Install the adaptor ring, Pc.2, with all taper pins Pc.7, and socket head screws Pc.6. Pre-stress the screws to 600 ft.lbs.

6.14 Protect the adaptor ring with light coat of oil to prevent corrosion.

REVISION												REF.
A												

DIM. EN POUCES/ DIM. IN INCHES
ÉCHELLE/SCALE =12
DES. DR. F.J. VER. CHK.
PROJ. PASS
APPR. PROJECTION
DATE 84/09/05

LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA
DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA

ERECTION PROCEDURE

HYDRAULIC | FEUILLE SHEET 11 DE OF 24 | REV.

2 2 4 A 3 4 7 0 2

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS LEUR AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.
MICROFILMED

7. MAIN SHAFT TO RUNNER COUPLING

7.1 Build convenient wooden platform (fieldmade) approximately 3 feet wide on top of the runner blades and around the hub.

7.2 Hone with fine oil stone the runner, dwg. 224F34714, machined flange then clean thoroughly . Locate the "H" mark stamped beside the flange.

7.3 Clean thoroughly the main shaft, dwg. 224D34719. Hone the lower flange coupling surface in same manner as the runner. Locate "H" mark stamped on the flange cylindrical surface.

7.4 To protect the shaft from witness or corrosion marks caused by hand contact against the shaft surface, it is recommended to apply coat of liquid car wax from and above the bearing journal up to the top end.

The bearing journal should be protected against rust and falling objects.

7.5 Raise the guide bearing inner oil sump dwg. 224D34723 as high as possible and secure.

7.6 Clean thoroughly all runner & shaft coupling nuts and bolts, dwg. 224C34729 .

7.7 Raise the shaft, then carefully lower through the head cover just above the runner coupling flange.

7.8 Ensure that both sides of the coupling surfaces are clean then apply with lint free wiper (not bare hand) a coat of boiled linseed oil.

Rotate the shaft in order to place the stamped "H" 180^{o} degrees with relation to the one on the runner.

Lower the shaft to just above the spigot then install one coupling bolt to align the coupling holes and complete shaft installation.

Install remaining bolts and secure with lockwashers and nuts. Pre-stress to 1250 ft. lbs. - 0 + 250.

Lock the nuts.

7.9 Paint the nuts and the whole area around.

REVISION	A												REF.

DIM. EN POUCES/ DIM. IN INCHES	LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA		
ÉCHELLE/SCALE =12			
DES. DR. F.J. / VER. CHK.			
PROJ. PASS. /		HYDRAULIC	FEUILLE SHEET 12 DE OF 24
APPR. / PROJECTION			REV.
DATE 84/09/05	ERECTION PROCEDURE	2 2 4 A 3 4 7 0 2	

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS LEUR AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

MICROFILMED

8. SHAFT SLEEVE

8.1 With reference to Dwg. 224F34720, clean and deburr the shaft sleeve thoroughly. Handle the sleeve with extreme care in order to not damage the highly polished outer cylindrical surface.

Small nicks shall be removed with fine oil stone. Honing shall be done in the direction of sleeve rotation NEVER across.

8.2 Check the main shaft, Dwg. 222D34719, bottom flange and remove all burrs or nicks with smooth file. Wash thoroughly the whole flange with special attention to the 10, 5/8" threaded holes. Blow them dry with compressed air.

8.3 Wash the 10, 5/8" studs, Pc. 16, Dwg. 224F34720, with solvent. Apply "Loctite" and install tight into the shaft flange.

8.4 Place the sleeve halves on suitable wooden blocks around the shaft below the head cover and assemble with studs, Pc. 15 and nuts, Pc. 14, Dwg. 224F34720. Use "Loctite" on the studs and nuts. Prestress studs to 75 ft.lbs.

Check the sleeve radial joints and ensure that they are perfectly matched. Blend the joints with fine oil stone. The stoning shall be done in the direction of sleeve rotation.

8.5 Raise the assembled sleeve. Clean shaft flange - sleeve mating surfaces and install.

Apply "Loctite" on the 10, 5/8" nuts Pc. 14, Dwg. 224F34720, and secure the sleeve tight. Prestress studs to 75 ft.lbs.

Ensure that the sleeve is feeler tight against the shaft flange.

8.6 Temporarily protect the sleeve polished surface to prevent damage.

REVISION	A												REF.

DIM. EN POUCES/ DIM. IN INCHES	LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA		
ÉCHELLE/SCALE =12			
DES. DR. F.J. / VER. CHK.			
PROJ. PASS			
APPR. / PROJECTION	ERECTION PROCEDURE	HYDRAULIC	FEUILLE SHEET 13 DE OF 24
DATE 84/09/05		2 2 4 A 3 4 7 0 2	REV.

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS LEUR AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

MIC ROFILMED

9. HEAD COVER INSTALLATION

9.1 Install lifting slings on the head cover, Dwg. 224F34711, using turnbuckles or come-a-longs on one end of each sling in order to be able accurately level the head cover. The head cover approximate weight is 17,000 lbs.

9.2 Raise the head cover off the wicket gate stems and level.

9.3 Wrap around the shaft sleeve, Dwg. 224F34720, Pc. 2, brass or steel shim stock 6" wide by 79-5/8" long approximately, secure in place with masking tape.

9.4 Verify the stay ring upper flange and head cover outer flange bottom for cleanliness.

9.5 Clean the wicket gate bushings in the head cover and sleeves on the wicket gates. Apply light coat of vaseline on both.

9.6 Apply on the upper stay ring flange a small bead of long drying sealing compound.

9.7 Orient the head cover with respect to the intake centerline and align with the wicket gate stems.

9.8 The lowering of the head cover will be controlled with care in order not to damage the plastic bushings and the main shaft sleeve.

9.9 Immediately after head cover installation, check the wicket gates top and bottom clearances.

9.10 Ensure that the shaft sleeve is not interfering in any way with the head cover. In the case it does, raise the shaft-runner assembly off the runner support bracket and adjust the head cover as necessary to obtain wicket gates correct alignment.

9.11 To obtain head cover correct alignment with relation to the wicket gates, the top clearance between nose and tail of each gate should be reasonably equal on all gates.

The difference between gate nose and tail should not exceed .005".

REVISION	A												REF.

DIM. EN POUCES/ DIM. IN INCHES
ÉCHELLE/SCALE =12
DES. DR. F.J. VER. CHK.
PROJ. PASS
APPR.
DATE 84/09/05
PROJECTION

LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA
DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA

ERECTION PROCEDURE

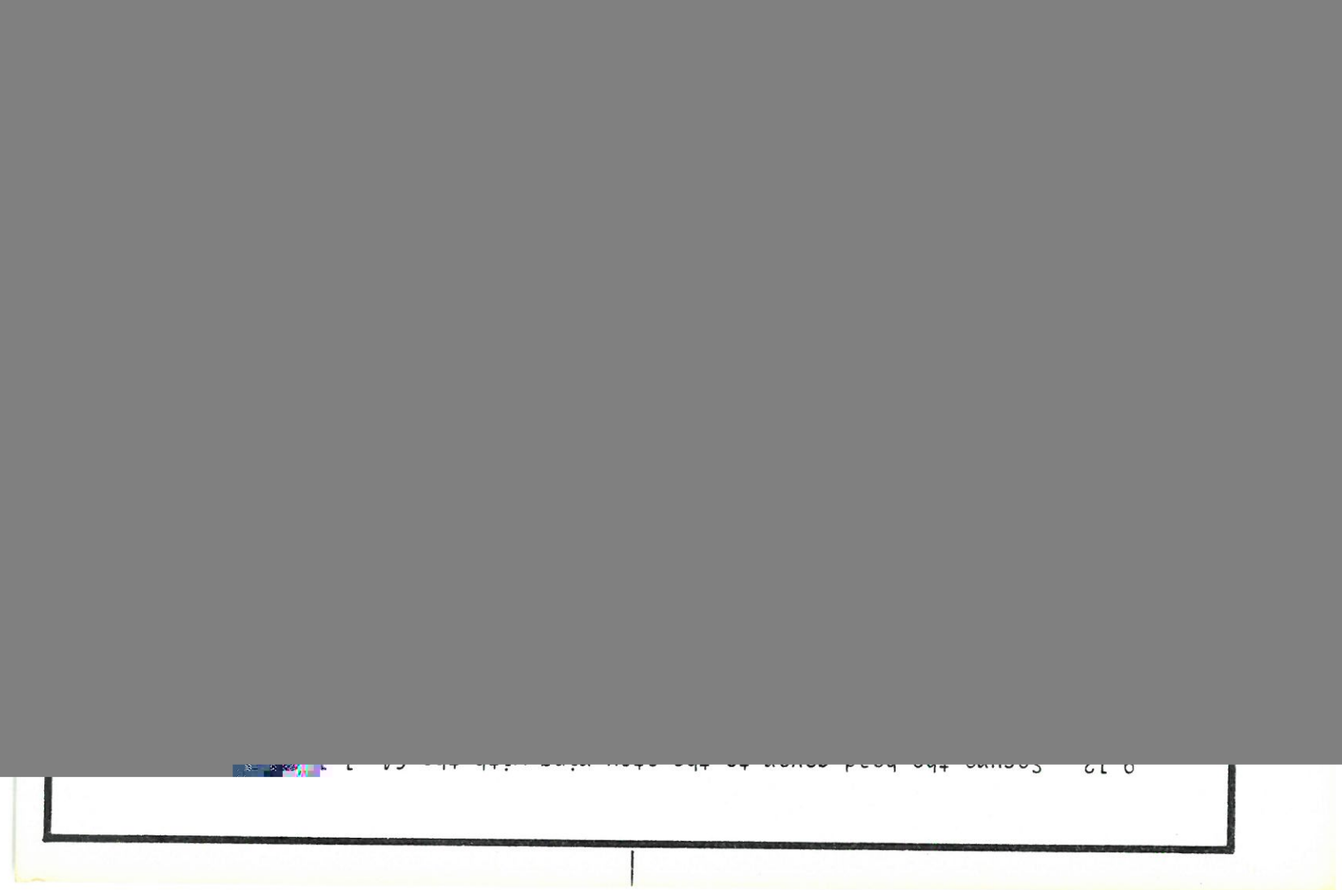
HYDRAULIC

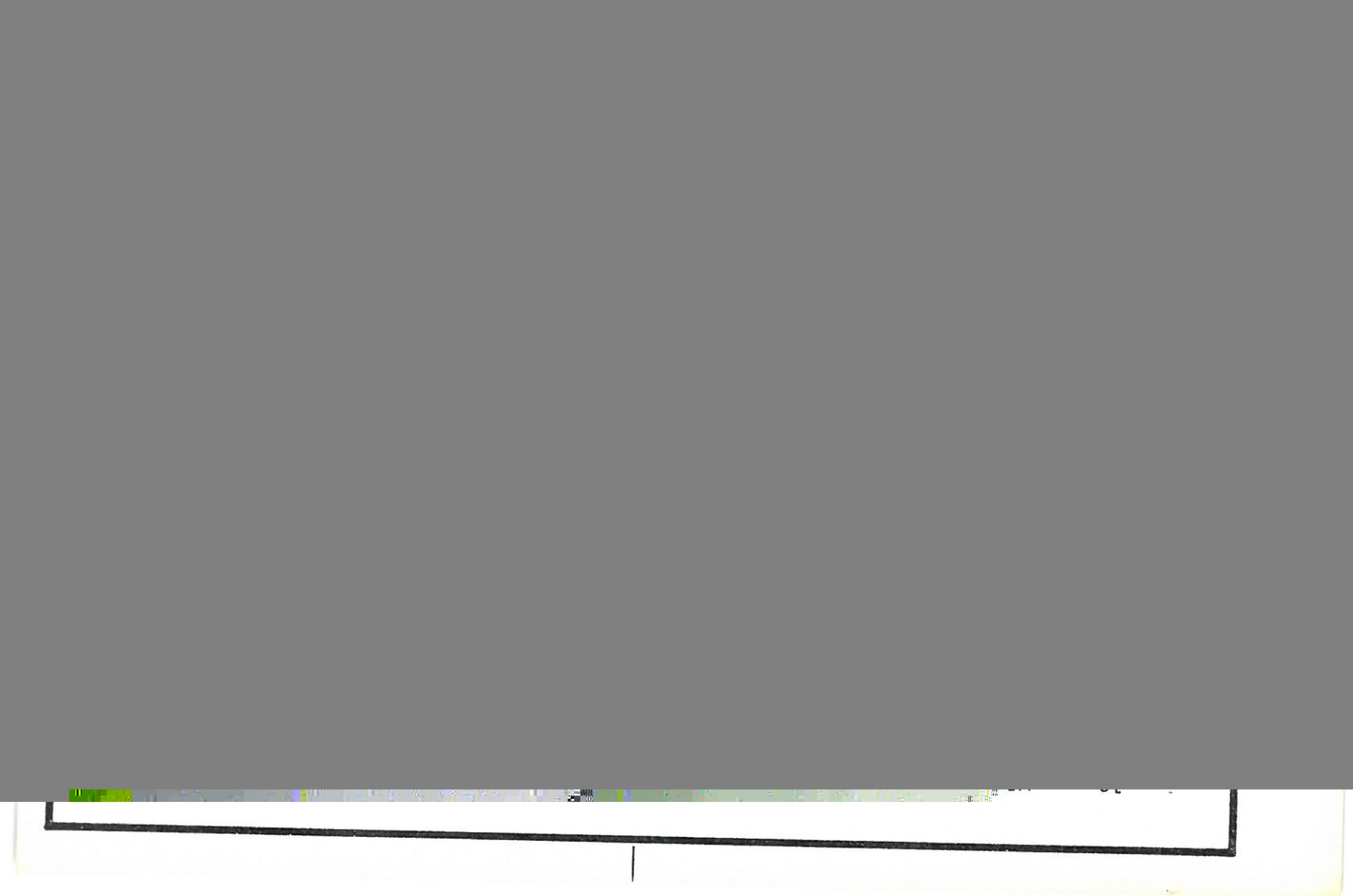
FEUILLE SHEET 14 DE OF 24

REV.

2 2 4 A 3 4 7 0 2

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE DOIT ÊTRE REPRODUIT





10.8 Install all excentric pins Pc. 10, connecting links Pc.28, breaking links Pc.29 , and including the link pins Pc. 15, Dwg. 224F34726.

10.9 Adjust excentric pins as close as possible to shop setting. Do not prestress the excentric pins nut Pc. 22, at this time, only snug tight.

10.10 Wrap around the wicket gates horizontal centerline 3/8" or 1/2" wire rope with come-a-long in between, then snug tight. Place a piece of 2" x 4" x 10" long wood in between the cable and nose (thick end) of all wicket gates. Tighten come-a-long hard.

Check wicket gates vertical clearances at the contact point and adjust the excentric pins to ensure wicket gate closure.

If necessary, the tail end of wicket gate contact surface may be hand dress to suit.

10.11 Upon completion of wicket gates adjustment, torque the excentric pin nuts Pc. 22, to 345ft.lbs. (lubricated).

10.12 Remove the wire rope strapped around the wicket gates and ensure that the area around them is maintained clear at all times.

10.13 Check wicket gate clearances at the top, bottom and between contact points. Record in QCIR-4.

10.14 Clean the servomotor mounting flanges and at pit liner pockets thoroughly.

10.15 Install servomotors into their respective location. Do not install the dowel pins nor torque the nuts at this time.

10.16 With the operating ring in gate "CLOSED" position, extend servomotor #2 (the one on the right side looking from the center of the unit towards the servomotors) connecting rod out completely.

10.17 Place small jack under the servomotor, then adjust the servomotor elevation to align the rod end with the operating ring.

Maintain the servomotor oil piping connecting flanges level.

Tighten the servomotor base nuts and torque to 250 ft.lbs.

REVISION													REF.
	A												

DIM. EN POUCES/ DIM. IN INCHES
ÉCHELLE/SCALE =12
DES. DR. F. J. | VER. CHK.
PROJ. PAS
APPR. | PROJECTION
DATE 84/09/05

LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA
DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA

ERECTION PROCEDURE

HYDRAULIC | FEUILLE SHEET 17 DE OF 24 | REV.

2 2 4 A 3 4 7 0 2

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS LEUR AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

FILE ROTATED

10.18 If possible, use the existing dowels. If the reamed holes don't line up, reposition the dowel locations and drill and ream new ones or the same holes may be used with larger dowel pins.

10.19 Ensure that the connecting rod of the servomotor #2 is completely extended then back the connecting rod 3/8". Set the connecting rod end to the operating ring, lubricate the bushing with vaseline then install the connecting pin.

10.20 Move the operating ring with the help of two come-a-longs to fully "OPEN" position as indicated on the operating ring.

10.21 Pull the servomotor #1 (left side) connecting rod completely out with the piston against the stop inside the cylinder.

10.22 Proceed with the servomotor alignment in same manner as per Paras. 10.17 and 10.18

10.23 With the connecting rod of servomotor #1 fully extended, align the rod end with the operating ring. Lubricate the bushing in the rod with vaseline then install the connecting pin.

Record servomotor stroke in QCIR-5.

10.24 Verify the position of the stroke indicator plate and, if necessary, relocate to match the servomotor stroke indicator.

10.25 Install all servomotor oil piping and restoring mechanism up to the governor.

The servomotor oil piping shall be thoroughly washed and flushed prior to final installation.

10.26 Install wicket gates upper stem packing, Pc. 21, with the spacer split ring, Pc. 17, see Dwg. 224F34726. The packing gland should be finger tight only.

REVISION													REF.
	A												

DIM. EN POUCES/ DIM. IN INCHES	LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA		
ÉCHELLE/SCALE =12			
DES. DR. F.J. / VER. CHK.			
PROJ. PASS /	ERECTION PROCEDURE	HYDRAULIC	REV.
APPR. / PROJECTION		FEUILLE SHEET 18 DE OF 24	
DATE 84/09/05		2 2 4 A 3 4 7 0 2	

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS LEUR AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

MICROFILMED

11. UNCOUPLED ALIGNMENT CHECKS

11.1 When the generator work has progressed to the point where it will permit proceeding with the shafts coupling and uncoupled alignment checks, carry out the checks jointly with the generator supervisor.

11.2 Check the gap between the turbine and generator shafts coupling flanges, and flanges concentricity, 4 points.

11.3 Turn the generator shaft 180^{o}, 360^{o} degrees and repeat the measurements at each shaft turn.

Record in QCIR-6.

REVISION	A												REF.

DIM. EN POUCES/ DIM. IN INCHES		LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA
ÉCHELLE/SCALE =12		
DES. DR. F. J.	VER. CHK.	
PROJ. PASS		ERECTION PROCEDURE
APPR.	PROJECTION	HYDRAULIC — FEUILLE SHEET 19 DE OF 24 — REV.
DATE 84/09/05		2 2 4 A 3 4 7 0 2

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS LEUR AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.
MICROFILMED

12. SHAFT COUPLING AND ALIGNMENT CHECKS

12.1 Ensure that the turbine shaft coupling surfaces are thoroughly cleaned before shafts are pulled together.

12.2 Locate the "H" stamped on each shaft flange cylindrical surface and position diametrically opposite to each other.

12.3 Remove shims securing runner to the discharge ring installed in Para. 9.18.

12.4 Pull the shafts together with the erection bolts. Ream generator shaft coupling holes to suit turbine shaft. Install permanent coupling bolts and prestress as per drawing instructions. Lock the nuts with locking plates.

NOTE: Do NOT install nut guards at this time.

12.5 After shaft coupling completion suspend 4 plumb wires equally spaced around and in proximity of the main shaft.

Ensure that the turbine and generator components are free of temporary supports and/or bracings.

12.6 Proceed with rotational alignment checks and record the final measurements in QCIR-7.

12.7 After completion of the alignment checks, center the shaft journal to the 37.250" bore of the guide bearing adaptor ring, Dwg. 224C34722, within .005" on diameter. Secure runner in same manner as in Para 9.18.

REVISION	A											REF.

DIM. EN POUCES / DIM. IN INCHES	LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA		
ÉCHELLE/SCALE =12			
DES. DR. F. J. / VER. CHK.			
PROJ. PABS /			
APPR. / PROJECTION	ERECTION PROCEDURE	HYDRAULIC	FEUILLE SHEET 20 DE OF 24
DATE 84/09/05		2 2 4 A 3 4 7 0 2	REV.

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS LEUR AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

MICROFILMED

13. SHAFT SEAL PACKING INSTALLATION

13.1 With reference to Dwg. 224F34720, clean the shaft sleeve Pc. 2, and the whole housing area.

13.2 Fit and install the lower 2 packings Pc. 20, with the spacers Pc. 21.

13.3 Bolt the half round key Pc. 12, to the half of the lantern ring with the socket screw Pc. 28.

Align the half round key with the slot in the head cover and install including the other half of the lantern ring.

13.4 Install remaining packings and spacers.

NOTE: The packing Pc. 20, shall be fitted snugly into the housing, under no circumstances force shall be used for the packing installation.

13.5 Clean the gland ring halves Pc. 5, and assemble around the shaft. Orient with relation to the intake side and secure.

The gland ring should be finger tight only, to prevent shaft sleeve damage and overheating.

13.6 Install packing box water supply as far as practical at this time.

REVISION												REF.
A												

DIM. EN POUCES / DIM. IN INCHES
ÉCHELLE/SCALE =12
DES. DR. F.J. VER. CHK.
PROJ PASS
APPR.
DATE 84/09/05
PROJECTION

LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA
DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA

ERECTION PROCEDURE

HYDRAULIC FEUILLE SHEET 21 DE OF 24

2 2 4 A 3 4 7 0 2

REV.

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS LEUR AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

MICROFILMED

14. GUIDE BEARING AND INNER OIL SUMP INSTALLATION

14.1 Split the guide bearing, Dwg. 224F34721, clean thoroughly and polish the babbitt surface if needed.

14.2 Clean the shaft journal. Nicks can be removed with honing stone and the honing shall be done in the direction of shaft rotation never across.

14.3 Install with "Loctite" the 16, 3/4" studs Pc. 3, Dwg. 224C34722, into the bearing adapter ring Pc. 2.

14.4 Fit into the groove in the guide bearing joints the 3/16" Ø seal Pc. 30, Dwg. 224F34721 and secure in place with Silicone rubber Pc. 29. Ensure that both ends of each seal are sealed with the compound for the length of 1-1/2" as indicated in the drawing zone a-6, to prevent oil penetration.

14.5 Install a strong field made platform around the shaft just above the bearing journal.

Place the guide bearing halves on the platform. Orient with relation to the intake side and assemble.

14.6 Install 3 eyebolts equally spaced into the base of the coupling studs in the turbine generator shaft flanges, then suspend from them reliable come-a-longs.

14.7 Ensure that the assembled guide bearing is oriented to the intake side. Attach the come-a-longs and raise the bearing.

14.8 Remove the bearing assembly platform and re-clean the whole bearing area & shaft journal. Avoid bare hand contact with the journal after cleaning.

14.9 Carefully install the guide bearing. Do not lubricate at this time.

Immediately after installation, check the bearing radial clearances which should be no less than .005".

REVISION	A											REF.

DIM. EN POUCES/ DIM. IN INCHES		LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA	
ÉCHELLE/SCALE =12			
DES. DR. F.J.	VER. CHK.		
PROJ. PAS			
APPR.	PROJECTION	ERECTION PROCEDURE	HYDRAULIC / FEUILLE SHEET 22 DE OF 24 / REV.
DATE 84/09/05			2 2 4 A 3 4 7 0 2

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS LEUR AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÉS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.
MICROFILMED

14.10 Remove the come-a-longs from the bearing.

14.11 Center the guide bearing to the shaft journal within .001" and secure in position with the 16, 3/4 nuts Pc. 4, Dwg. 224C34722. Torque nuts to 156 ft.lbs. and lock with locking plates.

14.12 Take guide bearing clearance at 8 equally spaced points and record in QCIR-8.

14.13 Clean cover plate, Dwg. 224D34724 Pc. 1, and install. Orient to the intake side then bolt to the bearing.

14.14 Install felt packing Pc. 6, and the retaining ring Pc. 5. Tighten the retaining ring just enough so that the felt packing flattens and maintains approximately .010" clearance with the shaft.

14.15 To prevent bearing contamination during construction, it is recommended to seal the joint between the retaining ring and the shaft with masking tape.

14.16 With reference to the inner oil sump, Dwg. 224D34723, ensure the
seal ring Pc. 5, and the l

14.21 Install all guide bearing instrumentation.

14.22 Install head cover sump water pump with all associated piping, electrical conduits, wiring and controls.

14.23 Complete the shaft seal water supply piping.

14.24 With the wicket gates in closed position record on QCIR 11 the position of the eccentric pin.

REVISION	A												REF.

DIM. EN POUCES/ DIM. IN INCHES	LES ATELIERS D'INGÉNIERIE DOMINION LIMITÉE, MONTRÉAL, CANADA DOMINION ENGINEERING WORKS LIMITED, MONTREAL, CANADA		
ÉCHELLE/SCALE =12			
DES. DR. F.J. / VER. CHK.			
PROJ. PASS /			
APPR. / PROJECTION	ERECTION PROCEDURE	HYDRAULIC	FEUILLE SHEET 24 DE OF 24 / REV.
DATE 84/09/05		2 2 4 A 3 4 7 0 2	

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS LEUR AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

MICROFILMED

fa

ERECTION PROCEDURE

FOR

JACKSON BLUFF KAPLAN TURBINE

UNIT 3

The following procedure is furnished to assist the erection contractor in the installation of Kaplan type turbine.

It outlines a sequence of erection of the parts appropriate to the Jackson Bluff Turbine.

It is not intended to be an exhaustive procedure or substitute for the advice of the turbine manufacturer field representative.

Nothing in this procedure should be construed as relieving the erection contractor from the responsibility for the proper installation of all turbine parts.

REVISION													REF.
	A												

DIM. EN POUCES/ DIM. IN INCHES		ATELIERS D'INGÉNIERIE DOMINION, MONTRÉAL, CANADA DOMINION ENGINEERING WORKS, MONTRÉAL, CANADA	
ÉCHELLE/SCALE =12			
DES. DR. F.J	VER. CHK. JCB		
PROJ. PASS. B		HYDRAULIC	FEUILLE SHEET 1 DE OF 26
APPR.	PROJECTION	ERECTION PROCEDURE	2 2 6 A 3 4 6 0 3
DATE 85.04.03			REV.

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

MICROFILMED

1. Stay ring
2. Discharge ring - Draft tube liner
3. Bottom ring
4. Wicket gates
5. Runner and shaft
6. Shaft sleeve
7. Head cover and inner head cover
8. Head cover installation
9. Wicket gate operating ring and associated mechanism
10. Uncoupled alignment checks
11. Shaft coupling and alignment checks
12. Shaft seal packing installation
13. Guide bearing and inner oil sump installation
14. Internal oil head pipes and oil head assembly.

REVISION													REF.
	A												

DIM. EN POUCES/ DIM. IN INCHES		ATELIERS D'INGÉNIERIE DOMINION, MONTRÉAL, CANADA DOMINION ENGINEERING WORKS, MONTRÉAL, CANADA
ÉCHELLE/SCALE =12		
DES. DR. F.J	VER. CHK. JCP	
PROJ. PASS		HYDRAULIC — FEUILLE SHEET 2 DE OF 26 — REV.
APPR.	PROJECTION	
DATE 85.04.03	ERECTION PROCEDURE	2 2 6 A 3 4 6 0 3

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

MICROFILMED

1. STAY RING

1.1 Clean the upper stay ring flange and the bottom ring support thoroughly.

1.2 Take level readings of both surfaces and locate the lowest points.

1.3 With pin gauge determine the distance from the upper flange to the bottom ring support surface.

1.4 Grind level the stay ring upper flange within .010" from the highest to the lowest point.

1.5 The bottom ring support shall be ground level within .010" and the radial level shall be maintained within .005".

1.6 During the stay ring grinding process, consideration with respect to the distance between the two surfaces must be taken and maintained as per drawing specification.

1.7 The following measurements shall be recorded in QCIR-1 (15146)

a) Level of the stay ring upper flange
b) The roundness of the upper flange inner bore
c) The level of the bottom ring support surface
d) The radial level of the bottom ring support surface
e) The distance between the upper and lower surfaces .

Wash thoroughly the 48, 1-1/8" threaded holes in the stay ring upper flange then install all studs with "Loctite".

REVISION													REF.
	A												

DIM. EN POUCES/ DIM. IN INCHES
ÉCHELLE/SCALE =12
DES. DR. F.J VER. CHK. JCP
PROJ. PASS
APPR.
DATE 85.04.08
PROJECTION

ATELIERS D'INGÉNIERIE DOMINION, MONTRÉAL, CANADA
DOMINION ENGINEERING WORKS, MONTRÉAL, CANADA

ERECTION PROCEDURE

HYDRAULIC | FEUILLE SHEET 3 DE OF 26 | REV.

2 2 6 A 3 4 6 0 3

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

2. DISCHARGE RING - DRAFT TUBE LINER

Reference drawings : 226D34604 & 226F34605

2.1 Place short straight edge across the bottom ring support surface and from the straight edge base measure down 34-1/8", -0,+1/8"

Scribe circumferential line on the inner side of the draft tube liner. It is important to maintain the scribed line at the same elevation all around. High lite the scribed line with center punch marks.

2.2 Cut the liner in any most convenient manner (arc-air, gouging, etc.). However, ensure that the center punch marks remain visible after completion.

2.3 Grind the draft tube liner edge and prepare for welding.

2.4 Install the discharge ring, dwg. 226F34605 on the foundation ring.

2.5 Adjust the discharge ring elevation flush with the bottom ring support surface and secure.

2.6 Establish plumb centerline and center to the stay ring upper flange bolt circle within 1/32".

2.7 Check the discharge ring roundness and center to the plumb wire. Adjust as necessary to maintain within .020".

2.8 To retain the discharge ring within specified tolerances, it is recommended to install small field made steel blocks between the top of the discharge ring and the stay ring bottom ring support. The blocks should be tight fitted between the two and welded to the discharge ring.

2.9 With reference to the 18 holes in the discharge ring lower end by using them as a jig, drill and tap the foundation ring as shown in the drawing.

2.10 Insert the 18, 1"-8UNC studs tight into the foundation ring. Cut the studs approximately 1/16" longer then the discharge ring inside bore.

REVISION	A											REF.

DIM. EN POUCES/ DIM. IN INCHES
ÉCHELLE/SCALE =12
DES. DR. F. J. VER. CHK. JCP
PROJ. PASS
APPR.
DATE 85.04.08
PROJECTION

ATELIERS D'INGÉNIERIE DOMINION, MONTRÉAL, CANADA
DOMINION ENGINEERING WORKS, MONTRÉAL, CANADA

ERECTION PROCEDURE

HYDRAULIC | FEUILLE SHEET 4 DE OF 26 | REV.

2 2 6 A 3 4 6 0 3

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

2.11 Weld the studs to the discharge ring with care to ensure that the weld will not disturb the discharge ring alignment.

Recheck the discharge ring alignment & correct if necessary .

2.12 Grind the studs and the weld, flush with the discharge ring inside surface.

2.13 Fit the stainless steel lining in between the draft tube liner and the discharge ring. See dwg. 226D34604.

Weld the new lining to the draft tube liner first and only after the plate returned to the ambient temperature, the welding between the liner and discharge ring may proceed.

2.14 Grind all welds smooth with surrounding area & blend with profile. Do not undercut.

2.15 The discharge ring and draft tube liner may be grouted now.

When completed, ensure that all grout openings shall be sealed and ground smooth & flush.

The installation of the draft tube manhole frame with cover and the pockets for the maintenance platform is NOT part of DEW supply.

3. BOTTOM RING

Reference drawing : 226F34609

3.1 Establish intake centerline on the stay ring upper flange and on the top of the lower shroud. High lite the centerline with center punch marks, in order to have permanent reference.

3.2 Place suitable wooden blocks on top of the stay ring bottom ring support.

3.3 Clean the bottom ring halves Dwg. 226F34604 and the joints thoroughly. Protect the plastic bushings with pieces of plywood properly secured.

REVISION	A											REF.

DIM. EN POUCES/ DIM. IN INCHES	ATELIERS D'INGÉNIERIE DOMINION, MONTRÉAL, CANADA DOMINION ENGINEERING WORKS, MONTRÉAL, CANADA		
ÉCHELLE/SCALE =12			
DES. DR. F.J. / VER. CHK. JCP			
PROJ. PASS 3		HYDRAULIC	FEUILLE SHEET 5 DE OF 26
APPR. / PROJECTION			REV.
DATE 85.04.03	ERECTION PROCEDURE	226A346030	

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

MICROFILMED

3.4 Place the bottom ring halves on the blocking; apply light coat of red lead compound or equivalent on one side of the joint only.

Pull the joints together and secure with the 1"-8UNC nuts. Ensure that the bottom ring sections are perfectly aligned with respect to each other. Check that the bottom ring top surface and the inner bore do not have any steps then torque the nuts to 375 ft. lbs.

Tack weld nuts to the bottom ring to lock. Paint the whole area including nuts and studs with red lead paint.

3.5 Raise the assembled bottom ring, remove the blocking from underneath. Clean the bottom ring surface and the support surface in the stay ring thoroughly.

3.6 Rotate the bottom ring with reference to the intake centerline then lower on its support.

3.7 Center plumb wire to the discharge ring within .010" then center the bottom ring to plumb wire within .010".

Ensure that the scribed intake line on the bottom ring top surface is aligned to the line scribed on the stay ring shroud within 1/32".

3.8 To control bottom ring during the alignment process use steel wedges or shims between the bottom ring outer diameter and the stay ring shroud inner bore.

3.9 With 1-1/16" drill, spot mark the 16 bottom ring hold down holes into the support. Drill just enough to establish positive center.

3.10 Raise the bottom ring high enough in order to be able to work under it and secure in position with blocks for security .

3.11 Ensure that the drill is perfectly aligned to the previously established center then drill and tap for 1" - 8UNC.

3.12 Clean the tapped holes, the whole support surface and the bottom ring thoroughly.

REVISION													REF.
	A												

DIM. EN POUCES/ DIM. IN INCHES	ATELIERS D'INGÉNIERIE DOMINION, MONTRÉAL, CANADA DOMINION ENGINEERING WORKS, MONTRÉAL, CANADA		
ÉCHELLE/SCALE :12			
DES. DR. F. J. / VER. CHK. JCP			
PROJ. PASS 3		HYDRAULIC	FEUILLE SHEET 6 DE OF 26
APPR. / PROJECTION	ERECTION PROCEDURE	2 2 6 A 3 4 6 0 3	REV.
DATE 85.04.03			

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

3.13 With master hand level placed across the bottom ring support

3.25 Install runner support blocks into the discharge ring .

Record in QCIR-2

a) The plumb line centering to the stay ring upper flange bolt circle.

5. RUNNER AND SHAFT

Reference drawings: 226F34614,226F34619,226C34656 & 226D34693.

5.1 Ensure that the runner blades are in fully closed (flat) position. Raise the runner and install into the discharge

6. SHAFT SLEEVE

Reference Drawings: 226F34619 & 226D34679

6.1 With reference to Dwg. 226D34679, Pc. 1, clean and deburr the shaft sleeve thoroughly. Handle the sleeve with care in order not to damage the highly polished, outer cylindrical surface.

Small nicks shall be removed with fine oil stone. Honing shall be done in the direction of sleeve rotation never across.

6.2 Check the shaft bottom flange and clean as necessary to ensure shaft sleeve fit.

6.3 Wash the 8, 5/8" studs Pc. 15, Dwg. 226F34619 with solvent. Apply loctite Pc. 17, and install tight into the shaft flange.

6.4 Place the sleeve halves around the shaft and assemble with the 5/8" studs Pc. 6, and nuts Pc.7. To lock the nuts and studs use "Loctite". Torque nuts Pc.7, to 75 ft.lbs.

Check the sleeve joints and ensure that they are perfectly matched. If necessary, blend the joints with oil stone.

6.5 Install the [illegible] assembled sleeve and bolt to the shaft. Use "Loctite" to lock the nuts in place. Torque nuts to 75 ft. lbs. Ensure that the sleeve is feeler tight against the flange.

6.6 Temporarily protect the sleeve polished surface to prevent damage.

7. HEAD COVER AND INNER HEAD COVER

Reference Drawings: 226F34608 & 226F34611

7.1 Clean thoroughly the inner head cover, Dwg. 226F34608.

7.2 Ensure that the wearing ring liner Pc[illegible]

7.4 Fit seal ring Pc. 19, into the inner head cover top surface .

7.5 Clean the wicket gates top and bottom bushings in the head cover Dwg. 226E3461l, including the packing

8.4 Clean wicket gate bushings in the head cover and the wicket gate stems. Apply light coat of vaseline on both .

8.5 Apply on the upper stay ring flange small bead of sealing compound.

8.6 Orient the head cover with respect to the intake centerline and align with the wicket gate stems.

8.7 The head cover installation shall be carefully controlled in order to not damage the plastic bushings during the lowering process.

8.8 Immediately after installation, check wicket gate top and bottom clearances .

8.9 To obtain head cover correct alignment with relation to the wicket gates, the top and bottom clearance between nose and tail of each gate should be reasonably equal on all gates.

The difference between wicket gate nose and tail should not exceed .005".

8.10 Secure the head cover to the stay ring with the 48, 1-1/8" nuts. Prestress the studs carefully to 250 ft.lbs. (lubricated), to prevent head cover drifting.

8.11 Align the inner head cover Dwg. 226F34608, with the head cover. Check seal ring Pc. 19, and ensure that is correctly installed.

Install washers Pc. 16, and the 15, 3/4"-10 UNC capscrews Pc. 15. Pull up the inner head cover and bolt tight to the head cover. Prestress capscrews to 85 ft. lbs. (Lubricated).

In the case the supplied capscrews are too short for the inner head cover pull up , use temporary 3 longer bolts to suit.

8.12 Connect the crane to the main shaft and lift the shaft-runner assembly off the support blocks in the discharge ring.

8.13 Place the runner support fixture into the head cover around the shaft and assemble.

8.14 Remove the runner support brackets from the discharge ring. Plug the holes in the discharge ring with screw plugs & lock in place.

REVISION												REF.
	A											

DIM. EN POUCES/ DIM. IN INCHES	ATELIERS D'INGÉNIERIE DOMINION, MONTRÉAL, CANADA DOMINION ENGINEERING WORKS, MONTRÉAL, CANADA		
ÉCHELLE/SCALE =12			
DES. DR. F.J. / VER. CHK. JCP			
PROJ. PASS 3 / —			
APPR. / PROJECTION			
DATE 850403	ERECTION PROCEDURE	HYDRAULIC FEUILLE SHEET 12 DE OF 26	REV.
		2 2 6 A 3 4 6 0 3	

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

MICROFILMED

8.15 Lower the shaft runner assembly and rest on the shaft support fixture.

8.16 Center the runner to the discharge ring within .015" on dia., then check head cover centering with reference to the shaft. If necessary carefully reposition the head cover to maintain the alignment within .020".

8.17 Level the shaft upper flange within .001" on flange diameter.

8.18 When completed with the shaft-runner centering and levelling, suspend 4 plumb wires equally spaced, from the shaft upper flange.

Check the shaft plumbness and record in QCIR-3.

8.19 Secure the runner tight with shims placed between the runner blades and the discharge ring.

8.20 Determine the necessary shaft pull up and record in QCIR-3.

8.21 Dowel the head cover to the stay ring.

9. WICKET GATE OPERATING RING AND ASSOCIATED MECHANISM

Reference drawings: 226F34626 & 226C34628

9.1 Clean all wicket gates thrust washers Pc.4 & wearing plates Pc. 2, Dwg. 226C34628. Lubricate the thrust washer with vaseline, immediately prior to installation and install both.

9.2 Clean the gate levers and prior installation apply light coat of Molykote type "G" grease on the wall of the lever bore including the wicket gate stem.

Align the dowel pin half holes in the lever and the stem then install the lever.

Note that the gate levers connecting links, pins etc., are match marked with the wicket gates and must be installed in same manner.

9.3 Raise the wicket gate just enough to be able to place shim of suitable thickness between the wicket gate and bottom ring.

The shim thickness shall be adjusted to maintain uniform design clearance between the gate and head cover.

REVISION													REF.
	A												

DIM. EN POUCES / DIM. IN INCHES
ÉCHELLE/SCALE =12
DES. DR. F. J. VER. CHK. JCP
PROJ. PASS 3
APPR.
DATE 85 04 03
PROJECTION

ATELIERS D'INGÉNIERIE DOMINION, MONTRÉAL, CANADA
DOMINION ENGINEERING WORKS, MONTRÉAL, CANADA

ERECTION PROCEDURE

HYDRAULIC

FEUILLE SHEET 13 DE OF 16

REV.

2 2 6 A 3 4 6 0 3

CE DESSIN EST LA PROPRIÉTÉ DES ATELIERS D'INGÉNIERIE DOMINION. IL NE PEUT ÊTRE REPRODUIT NI COMMUNIQUÉ À DES TIERS SANS AUTORISATION ET DOIT ÊTRE RETOURNÉ APRÈS USAGE.
THIS DRAWING IS THE PROPERTY OF DOMINION ENGINEERING WORKS. IT MAY NOT BE USED OR COPIED EXCEPT AS EXPRESSLY AUTHORIZED BY IT AND MUST BE RETURNED AFTER SUCH USE.

MICROFILMED

9.4 Ensure that the gate lever is tight against the thrust washer then insert the taper pin Pc.26 dwg. 226F34626, lightly lubricated with Molykote grease or white lead.

Drive the pin gently but firmly into the lever and gate stem. Recheck the wicket gate top clearance and if in accord with the drawing, remove the shim from underneath the wicket gate.

9.5 Install wicket gate stem cover and secure with capscrew. Complete the remaining wicket gate in same manner.
Clean and install operating ring.

9.6 Verify the operating ring freedom of movement then place the "CLOSED" index mark (stamped on the operating ring) exactly on the intake centerline.

Secure in place to prevent accidental movement.

9.8 Install all eccentric pins Pc. 10, connecting links Pc. 11, break links Pc. 12, and including the link pins Pc. 15, Dwg. 226F34626.

9.9 Adjust eccentric pins as close as possible to shop setting. Do not prestress the eccentric pin nuts Pc. 22 & 23, at this time, only snug tight.

9.10 Wrap around the wicket gates horizontal centerline 3/8" or 1/2" wire rope with come-a-long in between, then snug tight. Place a piece of 2"x 4"x10" long wood in between the cable and nose (thick end) of all wicket gates. Tighten come-a-long hard.

Check wicket gates vertical clearances at the contact point and adjust the eccentric pins to ensure tight wicket gate closure. Record eccentric pins positions in QCIR-11.
If necessary, the tail end of wicket gate contact surface may be hand dressed to suit.

9.11 Upon completion of wicket gates adjustment torque the eccentric pin nuts Pc. 22, to 35 ft. lbs. (lubricated) and nut Pc. 23 to 100 ft.lbs. also lubricated.

9.12 Remove the wire rope strapped around the wicket gates and ensure that the area around them is maintained clear at all times.

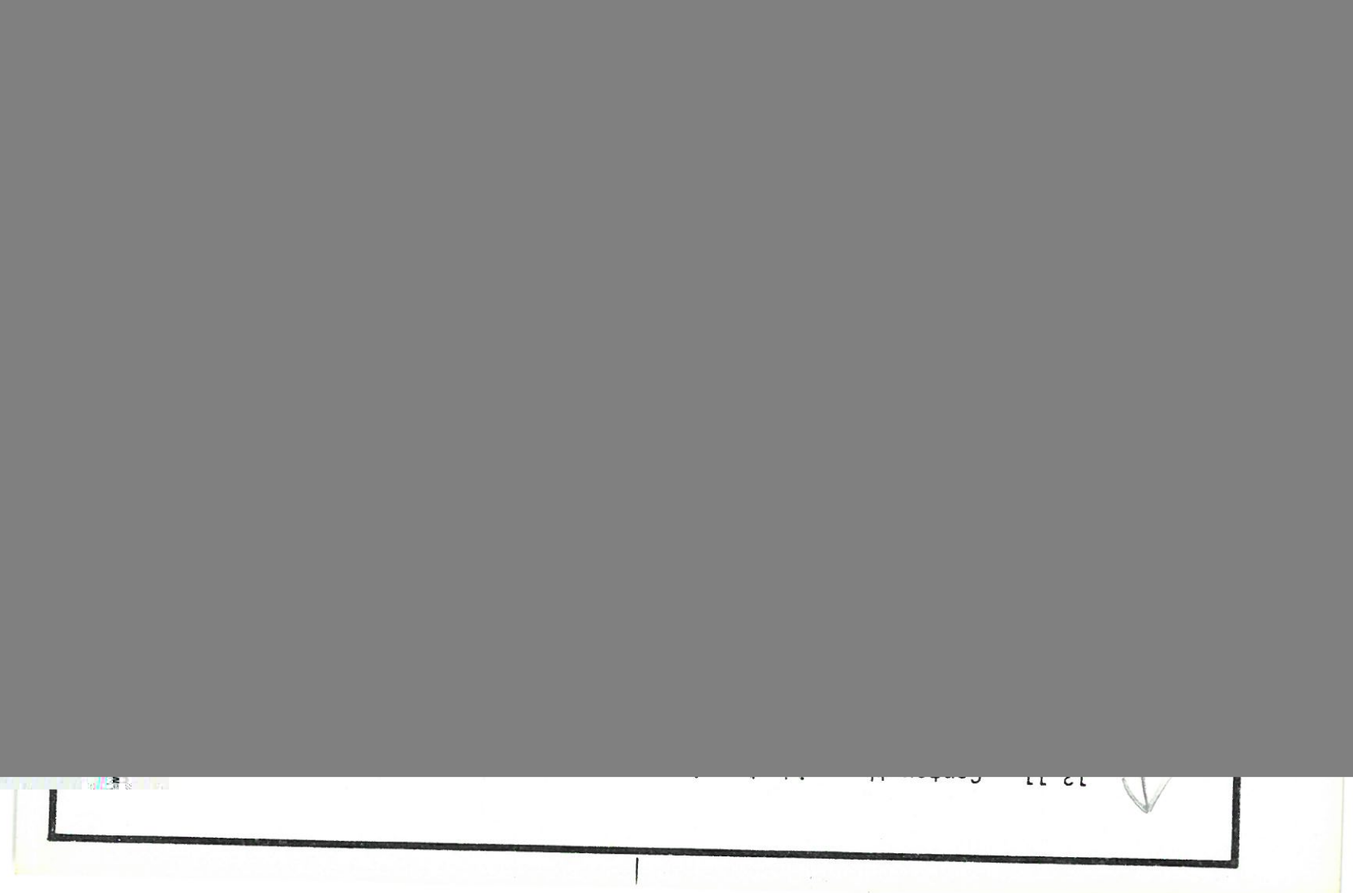
9.13 Check wicket gate clearances at the top, bottom and between contact points. Record in QCIR-4.

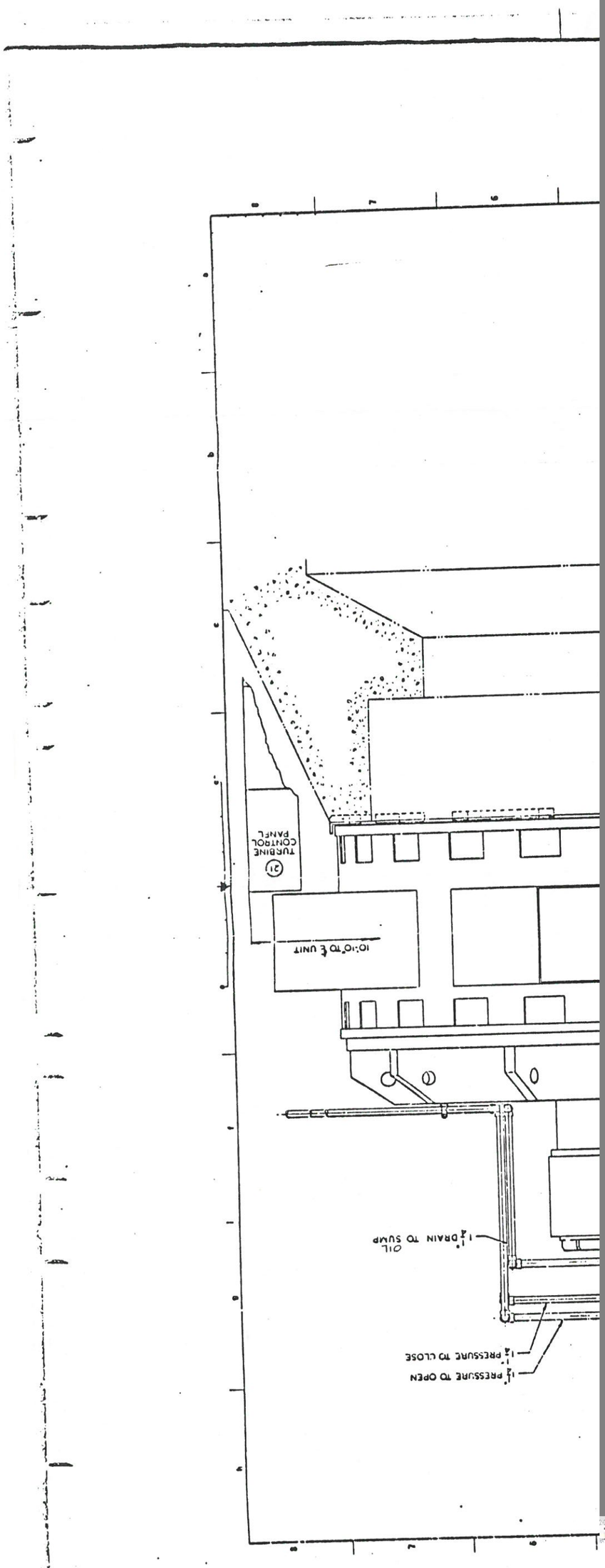
9.15 Install servomotors into their respective location. Do not install the dowel pins nor torque the nuts at this time.

9.16 With the operating ring in gate "CLOSED" position, extend servomotor #2 (the one on the right side looking from the center of the unit towards the servomo[illegible]



11.6 After shafts coupling completion, suspend 4 plumb wires equally spaced around and in the




TURBINE CONTROL PANEL
31
10'-10" TO E UNIT
OIL
1½" DRAIN TO SUMP
1½" PRESSURE TO CLOSE
1½" PRESSURE TO OPEN