TERREBONNE PARISH CONSOLIDATED GOVERNMENT

DEMOLITION OF COOLING TOWERS NO. 15 & NO. 16

****

ADDENDUM NO. 1

Date Issued: March 9, 2023

****

This Addendum No. 1 shall be part of the above referenced project.

Acknowledge receipt of this Addendum No. 1 by inserting its number in the space provided in the Louisiana Uniform Public Work Bid Form of the Request for Proposals. Failure to do so may subject the bidder to disqualification.

_____

Larry J. Dupre, P.E.

GIS Engineering, LLC.

TERREBONNE PARISH CONSOLIDATED GOVERNMENT

DEMOLITION OF COOLING TOWERS NO. 15 & 16

This Addendum is issued for the purpose of modifying, clarifying, or revising, as applicable, the specified items of the original Contract Documents. It is also issued for the purpose of adding, as applicable, the attached specified items to the original Contract Documents, or deleting, as applicable, the attached specified items from the original Contract Documents. The Addendum and attachments shall be construed as much a part of the original Contract Documents as contained therein. Changes made by Addenda shall take precedence over original Contract Documents.

GENERAL ANNOUNCEMENT

In the case that additional questions have been received but are not answered in this addendum, these questions will be answered in a subsequent addendum to be issued on a later date.

PART I – WRITTEN CONTRACTORS QUESTIONS

Contractor's written Questions and Engineer's Responses

PART II – MODIFICATIONS TO CONTRACT DOCUMENTS, TECHNICAL SPECIFICATION, PLANS, AND OTHER DOCUMENTS

Modifications to Contract Documents, Technical Specifications and Drawings.

PART III – ATTACHMENTS

PART I – Written Contractor's Questions

NOTE – The responses presented in PART I may differ from those presented in the Pre-Bid Conference. The responses in PART I are current as of the date of this Addendum and if different supersede those provided at the Pre-Bid Conference or any previous addenda.

Contractors' General Questions Received

1. They do not have a Bid Bond Form within the bid packet. Do they have a particular bid bond form/language that they would like issued? Or will the standard AIA Document A310 Bid Bond suffice?

   Response: Yes, the standard AIA Document A310 Bid Bond will suffice.

2. What is the piping to be capped with? Pipe Cap or Plate.

   Response: Welded Pipe Cap

3. Can you provide the project Site Address?

   Response: Houma Generation Station, 1551 Barrow Street, Houma LA, 70360

4. The drawings provided are not to scale and do not provide any dimensions. Are there any dimensions or as built drawings of the facilities available?

   Response: Please see attachment in Part III of this Addendum. These documents are for informational purposes only.

5. Are there any foundation drawings available? If not, what are the assumptions the contractor should make on removal limits?

   Response: No Foundation Drawings are available. Please see attachment in Part III of this Addendum. These documents are for informational purposes only.

6. Are there any hazardous materials to be remediated or a haz materials report?

   Response: Contractor is to remove and discard any hazardous material, gear oil, and any other fluids to the extents necessary within EPA guidelines.

7. Can the results of the chemical profile on the fluids to be drained be provided?

   Response: Contractor is to make his/herself familiar with project site and all fluids to be drained.

8. Will the parish remove water/debris from sumps prior to demolition or will that be part of the contractor's responsibility? If contractor, has hazardous materials analysis been performed?

   Response: Contractor will be responsible for the removal of Water/Debris from the sump.

9. Items S-02-4 & S-02-5 require cut and cap cooling pipe at +6.0 NAVD. What is the existing ground elevation? What size are these pipes?

   Response: The approximate elevation of natural ground near cooling piping is 10.3' NAVD (Cooling Tower No.16) and 10.6' NAVD (Cooling Tower No.15). Cooling Tower No. 16 pipe size is 48" and Cool Tower No. 15 pipe size is 24"(Contractor to field verify all piping prior to capping). These pipes shall be capped 6 feet above ground.

10. What is the estimated weight of cooling fans, gearboxes, and electric motors?

    Response: The following weights are estimated, contractor shall field verify weights prior to lifting: Cooling Tower Fan Motors (2,500 lbs.) each, Cooling Tower Gear Boxes (3,000 lbs.) each. Other items weight are unknown.

11. Are we salvaging the fiberglass shrouds?

    Response: All materials will be disposed of by the contractor.

12. What are we capping water pipe with? Welded plate?

    Response: See response to Question No. 2.

13. Are there any known asbestos containing materials?

    Response: To our best knowledge we have found no material on site containing asbestos. Contractor is to test any materials he/she believes to contain asbestos at No Cost to the Owner.

14. Is there any ground bearing pressure restrictions for that area? IE, I put up a crane to remove items I'm only allowed to put so many pounds per square inch coverage on the land.

    Response: Any equipment used in this area will be the means and methods of the contractor. Contractor shall return project site back to original condition prior to final acceptances.

15. You guys mentioned special PPE. What PPE requirements are there from the site?

    Response: All PPE must be in accordance with OHSA guideline.

16. Do you have any information on existing equipment with respect to the weight or make & models?

    Response: See response to Questions No. 4 and No. 10.

17. The scope of work is a little unclear where the stopping point is for demolition. When the demolition is finished the only thing that will be remaining is all pre-existing concrete and pumps?

    Response: Yes.

18. What concrete is to be removed if any? Drawings say sump to remain, while specs say "Limits: Exercise care to break concrete well for removal in reasonably small masses. Where only parts of a structure are to be removed, cut the concrete along limiting lines with a suitable saw so that damage to the remaining structure is held to a minimum."

    Response: No concrete is to be removed from sump area. Contractor to use cation during demolition of structures.

19. If breaking and removing anything below ground, what are the backfill specs?

    Response: All backfill material will need to be CH (Fat Clay) or CL (Lean Clay).

20. What schedule cap is required for the capping of the carbon steel lines?

    Response: Capping of carbon steel lines should be the same schedule as the line that is being capped.

21. Is there any NDE requirements for caping of the water lines? UT testing, PT, Xray?

    Response: No NDE testing will be required.

22. Anchor bolts protruding from the concrete. Will these need to be cut flush or capped?

    Response: Any items protruding from the concrete should be cut or capped.

23. Is any other piping to be removed other than the cooling tower supply lines(carbon steel lines to be capped Qty:3) and 2”PVC fill lines? There are other lines running on top of the sump and protruding out of the ground. Will these remain or only the pumps. If so do we need to cap all piping coming from the ground and blind the pumps?

    Response: Yes, please see Issued for Bid plan for this information.

24. There is a power line running to some area lighting to the left of the 3-cell cooling tower can this be temporarily removed pre construction by the owner?

    Response: Yes, the Owner can have this temporarily disconnected for the awarded contractor.

25. Is there any area restrictions for dumpsters? What all is allowable laydown area onsite?

    Response: There are no restrictions for dumpsters, the allowable laydown area is near the cooling towers.

26. At the pre-bid meeting you said there is no asbestos remaining on towers. Do you have the results as to furnish to my dumpsite?

    Response: Please see Part III – Attachments of this addendum for this information.

27. Are you wanting the entire structure taken down to the slab or just the fans and fan components taken out from the structure?

    Response: The entire structure should be taken down to the slab.

28. Is the system energized with coolant in any manner?

    Response: The system is not energized with coolant.

29. Is a performance bond required? Are any other methods of a performance guaranty acceptable?

    Response: Yes. A Performance Bond is required as per Paragraph 5.1 of Section I and also Section H of the Issued for Bid documents

PART II – Modifications to Contract Documents, Technical Specifications, Plans, and Other Documents

Contract Documents:

NONE

Technical Specifications:

NONE

Plans:

NONE

PART III - ATTACHMENTS

Pre-Bid Meeting Notes & Sign-In Sheet

ENGINEERING LLC

Coastal Design & Infrastructure
197 Elysian Dr.
Houma, LA 70363
P: (985) 219-1000 | F: (985) 475-7014
www.gisyeng.com

Date: March 1, 2023, 10:00 A.M.

Project: Terrebonne Parish Consolidated Government
Demolition of Cooling Towers No. 15 & No. 16
TPCG Project No. 23-ELECGEN-12
GIS Project No. 39130-1374

Location: GIS Engineering, LLC
197 Elysian Drive
Houma, LA 70363

PRE-BID CONFERENCE
AGENDA

SAFETY TOPIC: PPE (Presented by Joe Chauvin)

1. Roster Signatures and Introductions
    a. Owner – Terrebonne Parish Consolidated Government (TPCG)
    b. Engineer – GIS Engineering, LLC (GIS)

2. Scope of Work

    The work consists of providing all equipment, labor and material necessary for the demolition of Cooling Towers No. 15 and No. 16. Contractor will have to dispose of materials associated with the Cooling Towers No. 15 & No. 16 as shown on plans.

3. Delivery of Bids:

    Sealed bids will be received on Tuesday, March 14, 2023, by the Terrebonne Parish Consolidated Government (TPCG) Purchasing Division, at the City of Houma Service Complex, 301 Plant Road, in Houma, Louisiana until 2:00 P.M. as shown on the Purchasing Division Conference Room Clock, and, at the time and place, shall be publicly opened and read aloud. No bids will be received after 2:00 P.M.

4. Proper Preparation and Submission of Bids (*Section 10.0 of Section B – Instruction to Bidders)*
    a. Bids to be submitted by the time and at place indicated in the Invitation to Bidders and shall be enclosed in a sealed envelope.
    b. Envelope shall include Project title and name, address and state license number of the Bidder.
    c. Each Bid Proposal packet shall include:
        i. Completed Uniform Public Work Bid Form
        ii. Signature Authorization with written evidence of authority (LA R.S. 38:2212(B)(5))
        iii. Bid Bond with Power of Attorney, or Certified Check or Cashier's Check, all in the amount of 5% of the total amount of the bid.
        iv. Completed Unit Price Form.

5. Bid Completeness Requirements – *including, but not limited to, the following:*

    a. Acknowledgement of Addenda on Bid Proposal.
    b. Properly fill in unit price and extension price of each item included in the Bid Form.
    c. Complete bidder information as requested.
    d. Sign and Attest the bid.

6. Project Addenda:

    a. Clarifications in response to questions concerning Contract Documents will be issued in an Addendum.
    b. Send all questions to BidQuestions@gisy.com. Any questions submitted outside of this provided email address will not be considered. – Please be sure to add project name to the subject line.
    c. Addenda will be issued as soon as possible, but no later than Thursday, March 9, 2023 before 2:00 P.M. Addenda will be available at http//www.centralbidding.com by clicking on the Project Link, and will also be sent via email provided on the sign-in sheet for this meeting.

7. Contract Documents and Requirements:

    a. Listed in Section F – Standard Form of Agreement Between Owner and Contractor
    b. Contract Documents include complete Plan, Specifications, Addenda and Reference Documents.

8. General Project Information:

    a. Contract Time: 60 Calendar Days from Notice to Proceed.
    b. Estimated Project Budget: $475,000.00
    c. Required Contractor's License: Heavy Construction
    d. Liquidated Damages: $1,500.00 per day. Refer to Article 3 of Section F - Standard Form of Agreement Between Owner and Contractor of the Contract Documents for specifics.
    e. Contractor's Liability Insurance: Please refer to Paragraph 5.4 of Section I – General Conditions for requirements.
    f. There will be mandatory monthly progress meetings with Engineer and Owner personnel during construction.

9. Special Provisions
    a. 1.05 – Load Limits
    b. 1.09 – Maintenance of Drainage
    c. 1.12 – Damages to Site
    d. 1.13 – Time Constraints
    e. 1.14 – Tax Exemption
    f. 1.28 – Work Plan/Demo Plan – This will need to include how the contractor plans to demo the cooling towers as well as a timeframe.
    g. 1.32 – Necessary Permits for Material Disposal – This is required for FEMA purposes.
    h. 1.33 – Pre-Existing Site Conditions
    i. 1.34 – Site Cleanup
    j. 1.37 – Coordination with Engineer/Plant Manager

10. Agency/Owner Comments

11. Bid Questions & Responses

    a. Questions received prior to this pre-bid conference will be addressed in an upcoming addendum within the following days.
    b. All future questions shall be in writing and sent to the email address BidQuestions@gisy.com. We will not accept any questions over the phone or sent to direct emails.
    c. The last day to submit written questions will be Wednesday March 8, 2023 until 2:00 P.M.

12. Site Familiarity
    A site visit was conducted immediately following the meeting. Any additional site visits should be coordinated with Cyr Lebouef with TPCG.

13. Adjourn

Project Contact Information

GIS Engineering, LLC	985-219-1000
Christopher Jeanice, P.E.	Client Manager
Bill Blanchard .	Project Manager
Larry J. Dupre	Engineer of Record
Joseph Chauvin	Construction Manager
Ann Hebert `	Project Associate
Dwayne Veillon	Project Associate

ENGINEERING LLC

Terrebonne Parish Consolidated Government
Demolition of Cooling Towers No. 15 & No. 16
TPCG Project No. 23-ELECGEN-12
Wednesday, March 1, 2023
10:00 A.M.

ATTENDANCE REGISTER

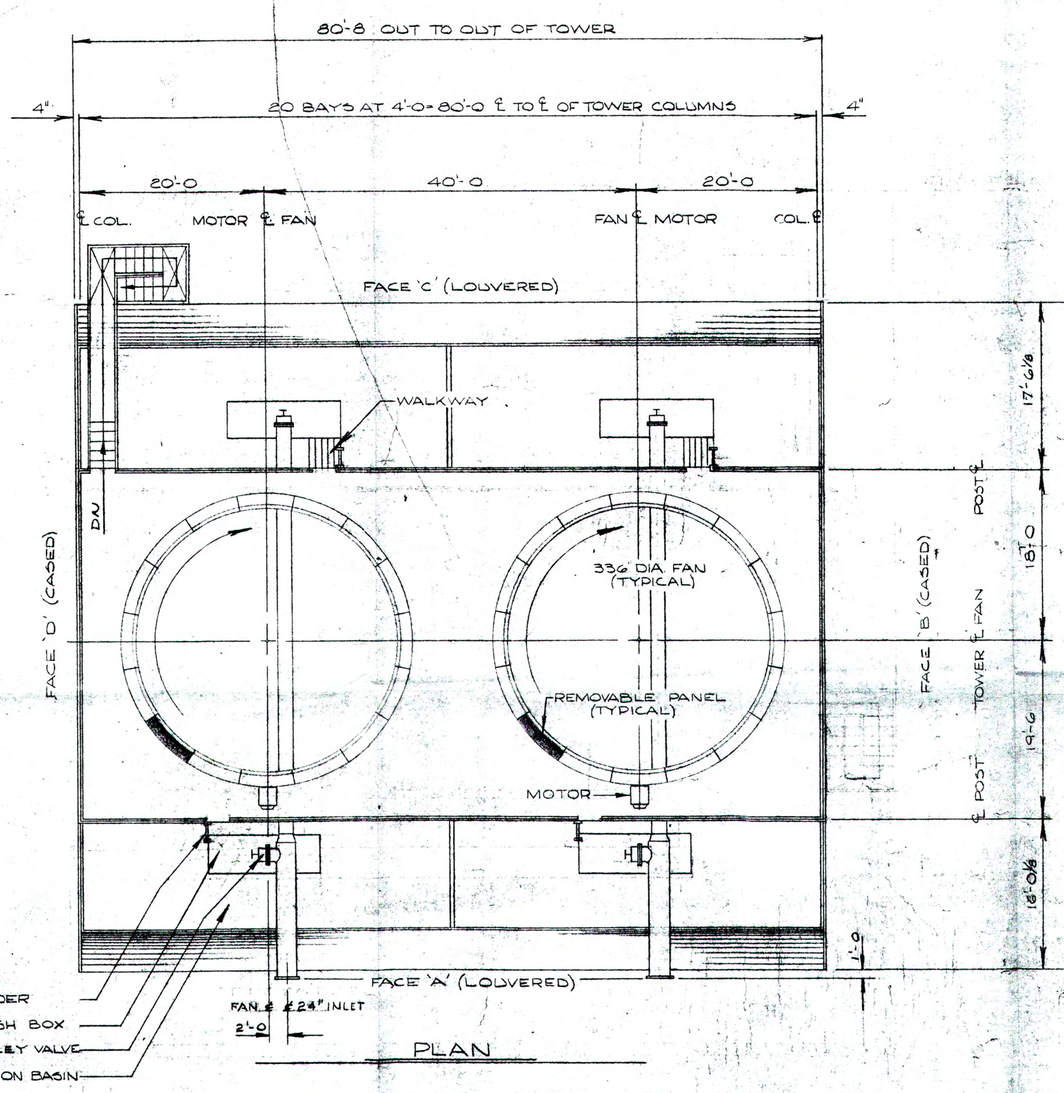
NAME	COMPANY NAME	PHYSICAL ADDRESS	TELEPHONE NUMBER	EMAIL ADDRESS
Kenneth Alonzo	BradBerry construction	1009 North Bayou Dr.	985-213-6406	Kalonzo@construct@.gmail.com
Dakota Hudspeth	BradBerry construction	107 Andre Ln Golden Meadow La 70357	337 240 1524	Dakota@bradberryconstruct.com
Justin Shilling	Bradberry Construction	1115 Lakeridge lane Lake Charles, LA, 70605	337-660-1795	Justins@bradberryconstruct.com
Dwayne Veillon	GIS Engineering	197 Physician Dr Houma LA	985-665-2388	dveillon@gisy.com
Kevin Passman	Sealevel	1069 Hwy 3185 Thibodaux	985-414-5712	Kpassman@sealevelinc.com
Peggy Voljoin/Hunter Voljoin	Garden Environments Inc DBA - Wolf group Construction	4433 Ligustrum St Metairie La. 70001	(504) 756-5554	Wolfgroupconstruction@gmail.com.
Clayton Jinks	DELSOL Consultins		337-707-0141	cjinks@delsol-consulting.com
Jason Guy	Royal Engineering	1501 Religious St, NOLA	504-940-8887	jguy@royalengineering.net
Joe Chauvin	GIS Eng		985-258-9279	jchauvin@gisy.com
Bill Blanchard	GIS Eng.		985-665-2114	billb@gisy.com

	NAME	COMPANY NAME	PHYSICAL ADDRESS	TELEPHONE NUMBER	EMAIL ADDRESS
	JIM H. PELLEGRIN &	FRISCO CONST.	128 W WOODLAWN RANCH Rd. Houma	985 876 3807	JIMPELLEGRIN@FRISCOCONSTRUCTION CO.COM
	Stephanie Thompson	Volutey Inc.	318 Venture Blvd Houma, LA 70360	985-876-6187	Steph@coastalvolute.com
	DAVID ROBICHAUX	LOW LAND	206 FROUS AVE C HOUMA 70363	985-985-446-1314	lowland@lowlandcc1.com gene@lowlandcc1.com
14	Derek Hood	Pro Scales & Construction Services	20555 Greenwell Springs, Rd Greenwell Springs, LA 70739	225-588-7781	Hood@PSACS.Net
15	Cye A. LeBoeuf	TPCG	1551 BARROW ST	985-873-6776	CLeboeuf@tpcg.org
16	Ann Hebert	GIS Engineering, LLC	197 Elysian Drive Houma, LA	985-219-1001	ahebert@gisy.com
17					
18					
19					
20					
21					
22					
23					

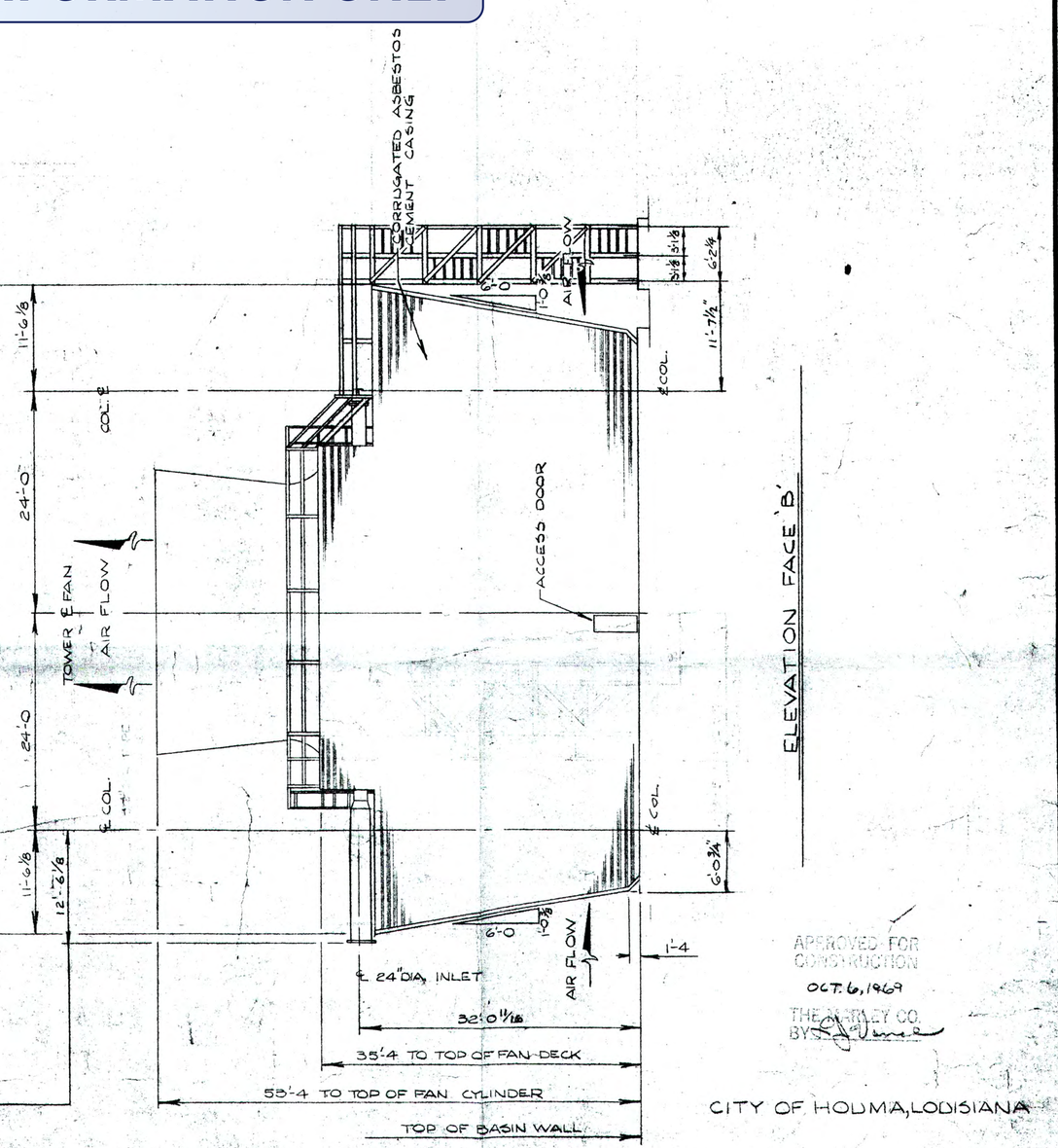
PART III - ATTACHMENTS

Cooling Towers Information

INFORMATION ONLY



PLAN



ELEVATION FACE 'B'

MARLEY PIPEWORK STOPS AT FACE OF 24" DIA. FLAT FACED FLANGE WHICH IS DRILLED TO CONFORM TO CLASS 125 A.S.A. B 16.1 SPECS. CAUTION -- MARLEY PIPE SUPPORTS ARE DESIGNED TO SUPPORT ONLY THE WEIGHT OF PIPE AND WATER TO FACE OF THIS FLANGE. THE PIPING DETAILER MUST PROVIDE SUPPORT FOR ALL PIPEWORK BEYOND THIS FLANGE. CARE MUST BE TAKEN WHEN INSTALLING CONNECTING PIPING TO AVOID OVERLOADING OR DAMAGING THE TOWER STRUCTURE.

APPROVED FOR CONSTRUCTION
OCT. 6, 1969
THE MARLEY CO.
BY

CITY OF HOUMA, LOUISIANA

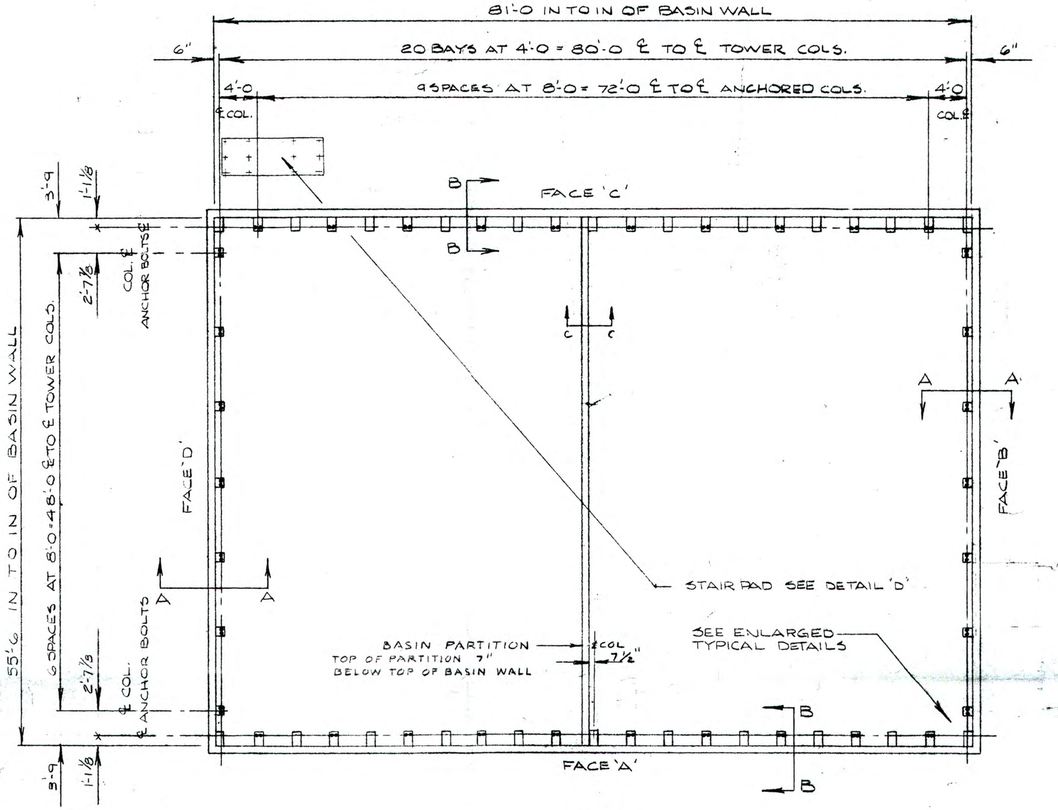
LTR	DATE	REVISION	BY	CHKD
D	10-6-69	PER CO# 21	RMC	ALD
C	10-7-68	PER CO# 7	NEW	SLH
B	4-30-68	PER CO# 8	SWB	SEH
A	3-11-68	CWO	SWB	MPC

SCHEMATIC VIEWS FOR A 6516-0-2 D.F. COOLING TWR

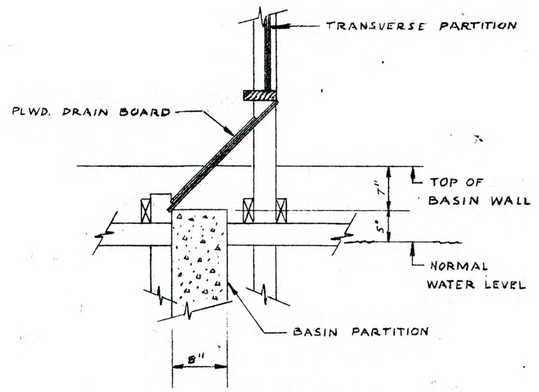
UNIT 16 THE MARLEY COMPANY
KANSAS CITY, MISSOURI

SCALE	DATE	DRAWN	CHECKED	APPROVED
NONE	3-11-68	SWB	MPC	ERK

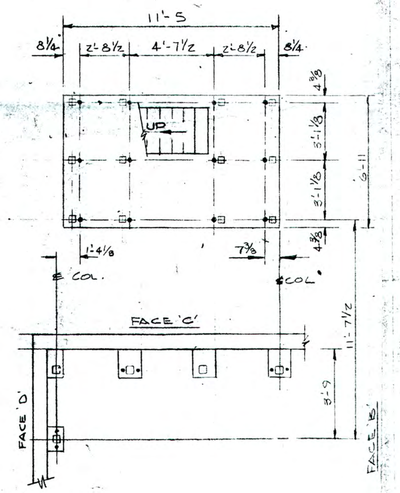
O.O.# 12-38-68 DRAWING NO. 68-4700



PLAN



SECTION C-C



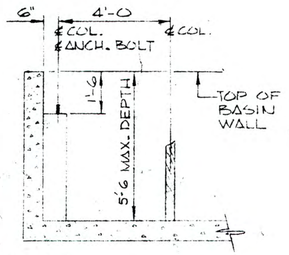
DETAIL 'D'

GENERAL NOTES

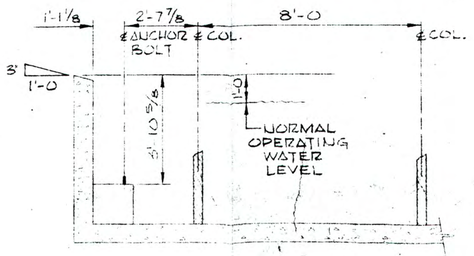
1. PURCHASER TO DESIGN, CONSTRUCT AND FURNISH FOUNDATION COMPLETE TO SUIT THE DIMENSIONS OF THIS DRAWING. BASIN DESIGNER SHOULD REFER TO SCHEMATIC VIEWS AND AVOID LOCATION OF SUMP SCREENS, PUMPS AND ADJACENT EQUIPMENT THAT WILL INTERFERE WITH SLOPING AND OVERHANGING TOWER FACES OR STAIRWAY.
2. PURCHASER TO DESIGN, LOCATE AND FURNISH SUMP TO SUIT JOB REQUIREMENTS.
3. CONCRETE SURFACES AT TOWER ANCHORAGE MUST BE AT INSTRUMENT LEVEL WITHIN ± 1/8" OF ELEVATIONS SHOWN AND TROWELED TO A SMOOTH FINISH BY PURCHASER. THIS WORK MUST BE COMPLETED BEFORE TOWER CONSTRUCTION BEGINS. INTERIOR UNANCHORED COLUMNS ARE FIELD CUT TO FIT THE BASIN FLOOR A MAXIMUM OF 5'-6" BELOW TOP OF CONCRETE BASIN WALL.
4. SLOPE OF BASIN FLOOR SHOULD NOT EXCEED 2'-0 PER 100'-0.
5. PURCHASER TO FURNISH ALL ANCHOR BOLTS COMPLETE WITH NUT AND WASHER.
6. DEAD LOADS SHOWN ARE FOR OPERATING TOWER ONLY, WEIGHT OF CONCRETE BASIN AND WATER IN BASIN ARE NOT INCLUDED. WIND LOADS ARE BASED ON 40# PSF.

TOTAL TOWER OPERATING WEIGHT	603,000
MAX. DEAD LOAD AT ANY PILASTER	5,000
MAX. DEAD LOAD AT BASIN FLOOR	9,800
MAX. DEAD + WIND LOAD AT ANY PILASTER	15,500
MAX. DEAD + WIND LOAD AT BASIN FLOOR	13,800
MAX. NET UPLIFT ANY ANCHOR POINT	8,200
MAX. HORIZ. WIND LOAD ANY ANCHOR POINT	7,700

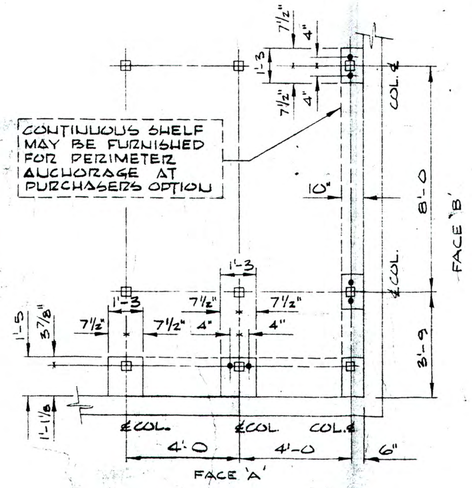
NOTE -- ALL PILASTERS ALONG FACES 'A' & 'C', INCLUDING THE CORNER PILASTERS, ARE 3'-10⅝ BELOW TOP OF BASIN WALL. ALL OTHER PILASTERS ARE 1'-6 BELOW TOP OF BASIN WALL.



SECTION A-A



SECTION B-B



ENLARGED TYPICAL DETAILS

PILASTER DIMENSIONS ARE MINIMUM.

ANCHOR BOLTS TO BE 1" DIA. WITH 2½" THREAD AND 3" PROJECTION ABOVE FINISHED CONCRETE. (68 REQUIRED) LOCATE TO WITHIN ± 1/8".

STAIR NOTES --

STAIR SLAB TO BE AT SAME ELEVATION AS TOP OF BASIN WALL.

MAXIMUM LOAD AT ANY STAIR COLUMN IS 1250#.

1" DIA. ANCHOR BOLTS WITH 1½" THREAD AND 2" PROJECTION ABOVE FINISHED SLAB. (12 REQUIRED)

APPROVED FOR CONSTRUCTION
OCT. 6, 1969
THE MARLEY CO.
BY

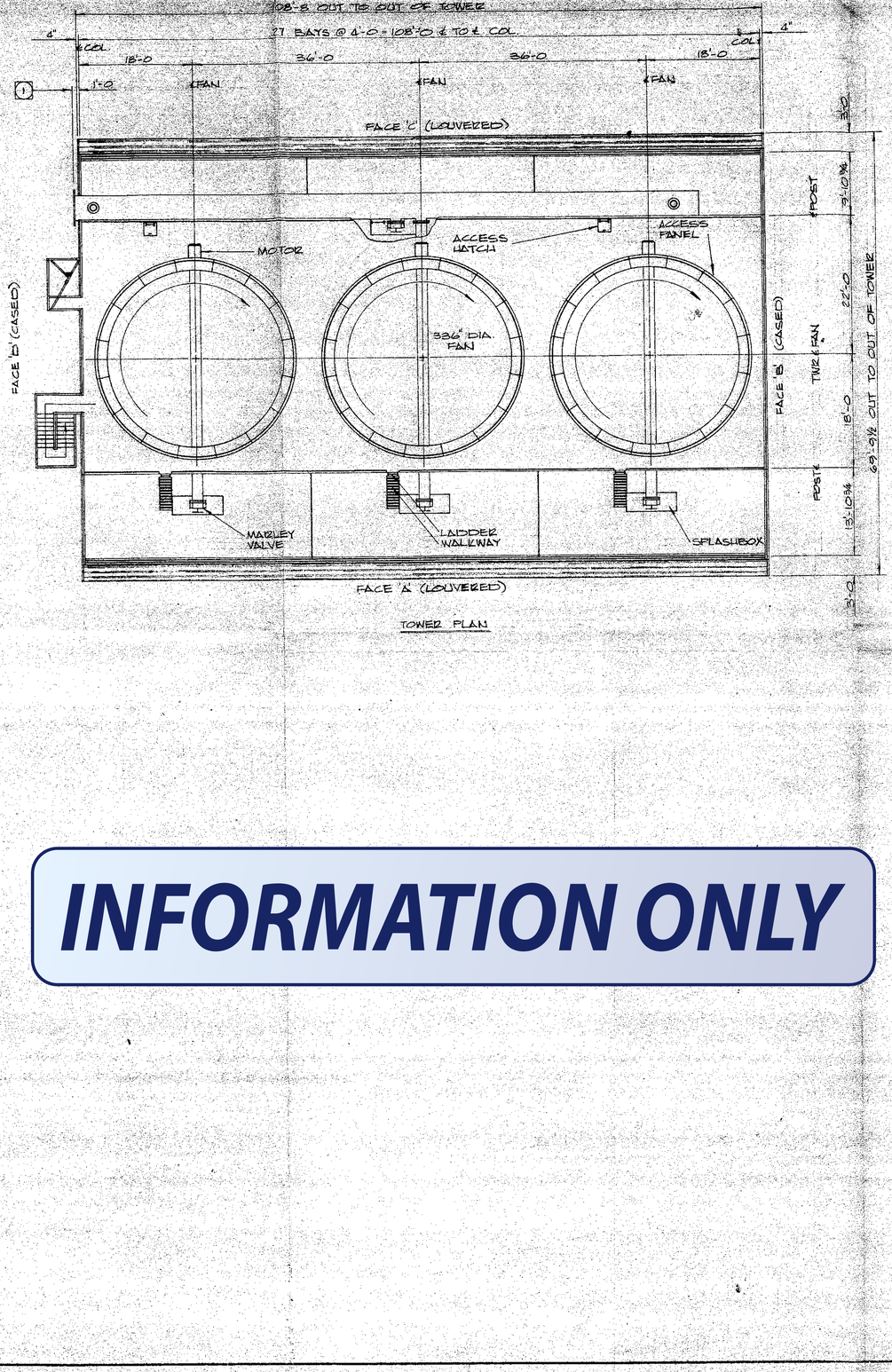
CITY OF HOUMA, LOUISIANA

LTR	DATE	REVISION	BY	CH'KD
F	10-6-69	PER COS 12	RMG	
E	11-18-68	PER COS 10 & 11	NEW	SLH
D	10-31-68	PER COS 9	NEW	RMG
C	10-7-68	PER COS 7	NEW	SLH
B	5-7-68	PER COS 3	RDM	SLH
A	3-11-68	CWD	JDB	

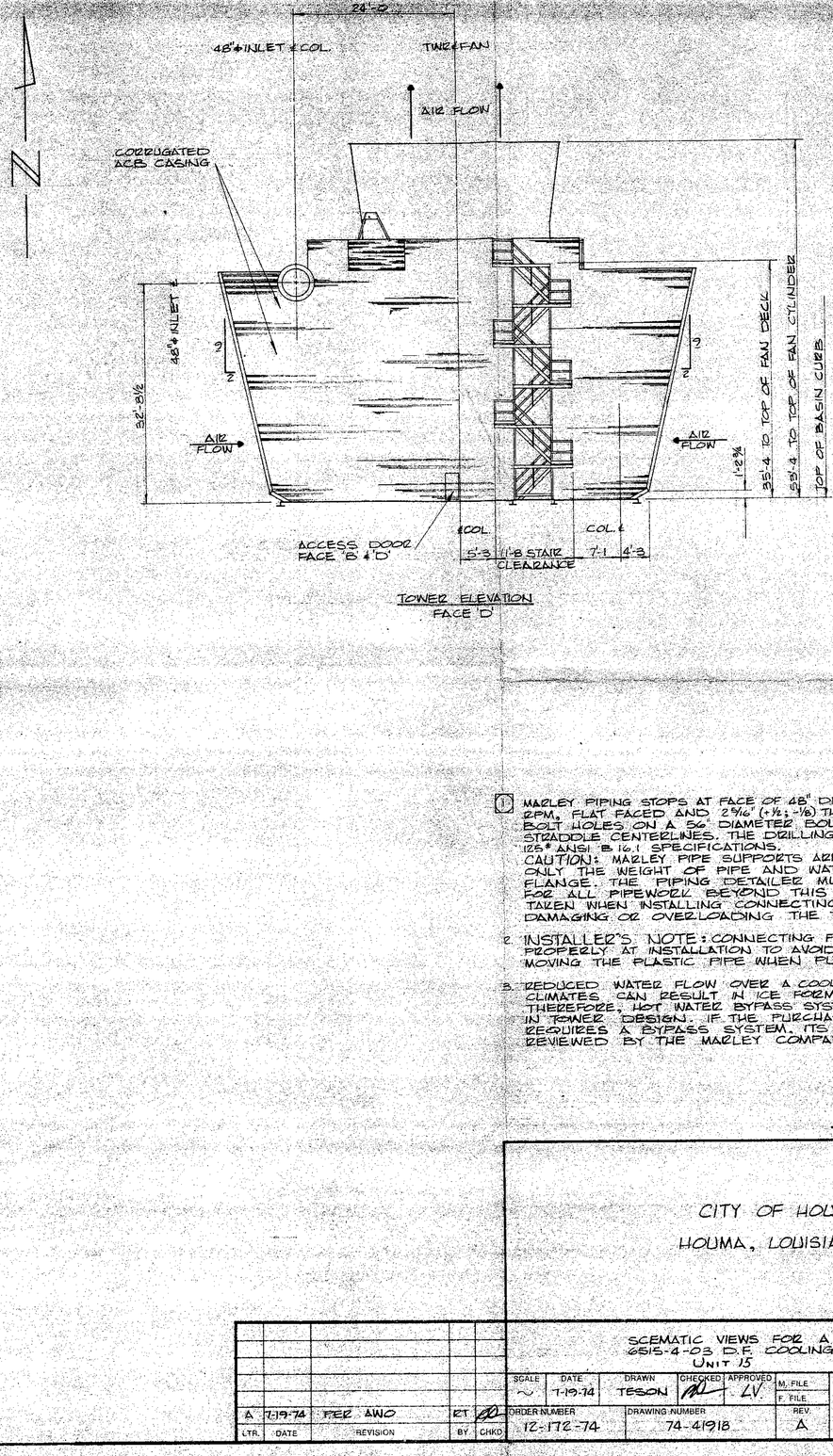
BASIN VIEWS FOR A 6816-0-02 D.F COOLING TWR.
UNIT 16 THE MARLEY COMPANY
KANSAS CITY, MISSOURI

SCALE	DATE	DRAWN	CHECKED	APPROVED
NONE	3-11-68	JDB		

OC# 12-38-68 DRAWING NO. 68-4704 REV. F



TOWER PLAN



TOWER ELEVATION
FACE 'D'

INFORMATION ONLY

1. MARLEY PIPING STOPS AT FACE OF 48" DIAMETER FLANGE. FLANGE IS 2PM, FLAT FACED AND 2 5/16" (+½; -⅛) THICK. 44-1¾" DIAMETER BOLT HOLES ON A 56" DIAMETER BOLT CIRCLE. BOLT HOLES STRADDLE CENTERLINES. THE DRILLING CONFORMS TO CLASS 125* ANSI B 16.1 SPECIFICATIONS.
   CAUTION: MARLEY PIPE SUPPORTS ARE DESIGNED TO SUPPORT ONLY THE WEIGHT OF PIPE AND WATER TO FACE OF THIS FLANGE. THE PIPING DETAILER MUST PROVIDE SUPPORT FOR ALL PIPEWORK BEYOND THIS FLANGE. CARE MUST BE TAKEN WHEN INSTALLING CONNECTING PIPING TO AVOID DAMAGING OR OVERLOADING THE TOWER STRUCTURE.
2. INSTALLER'S NOTE: CONNECTING PIPING MUST BE ALIGNED PROPERLY AT INSTALLATION TO AVOID AVOID DAMAGING OR MOVING THE PLASTIC PIPE WHEN PULLING UP FLANGE BOLTS.
3. REDUCED WATER FLOW OVER A COOLING TOWER IN COLD CLIMATES CAN RESULT IN ICE FORMATION IN THE FILL. THEREFORE, HOT WATER BYPASS SYSTEMS ARE NOT INCLUDED IN TOWER DESIGN. IF THE PURCHASER'S APPLICATION REQUIRES A BYPASS SYSTEM, ITS DESIGN MUST BE REVIEWED BY THE MARLEY COMPANY.

IMPORTANT
THIS DRAWING MUST BE RETURNED
BY AUG 23 1974 TO
THE MARLEY COMPANY
MISSION, KANSAS OFFICE
TO INSURE SHIPMENT AS PROMISED.

CITY OF HOUMA
HOUMA, LOUISIANA

SUBMITTED FOR APPROVAL
JUL 26 1974
THE MARLEY CO.

SCEMATIC VIEWS FOR A MODEL
6515-4-03 D.F. COOLING TOWER
UNIT 15

LTR.	DATE	REVISION	BY	CHKD
A	7-19-74	PER AWO	RT	

SCALE	DATE	DRAWN	CHECKED	APPROVED	M. FILE
~	7-19-74	TESON		LV.	F. FILE

ORDER NUMBER	DRAWING NUMBER	REV.
12-172-74	74-41918	A

THE MARLEY CO.
MISSION, KANSAS 66202

INFORMATION ONLY

MARLEY

MANUAL

Class 600 Industrial
CROSS-FLOW COOLING TOWERS

•

Operation and Maintenance Instructions

FEBRUARY, 1986

OM-600J

5800 Foxridge Drive – P.O. Box 2912 – Mission, Kansas 66201

PRINTED IN U.S.A.

TABLE OF CONTENTS

MARLEY

cooling tower

OPERATING MANUAL

PREPARED FOR City of Houma

Houma, Louisiana

Unit 15

GPM 26,000 HW 103.0 CW 89.0 WB 68.0

Tower Model No.	6516-0-02
Tower Serial No.	6516-12-38-68
Customer Order No.	1706-313
Marley Order No.	12-38-68
Geareducer & Ratio	Series 34.3T 11.18 to 1 ratio
Fan Diameter	336" dia.
Trial Fan Pitch	18 degrees
Fan R.P.M.	157
Contract Brake Horse Power	68
Driveshaft	R-1 Class II
Flow Control Valve Size	18"
Float Valve Size	N/A
Specials	

Please refer to Marley Order Number and Tower Serial Number in correspondence concerning this tower.

THE MARLEY COOLING TOWER COMPANY

5800 Foxridge Drive — Mission, Kansas 66202

Class 600 Industrial
CROSS-FLOW COOLING TOWERS

Operation and Maintenance Instructions

GENERAL

These instructions will assist in obtaining efficient, long life from Marley cooling equipment. Direct questions concerning tower operation and maintenance to your Marley sales office or representative. Always include your tower serial number when writing for information or ordering parts. Look for this number on the nameplate near the access door.

PRE-STARTING PROCEDURE

CLEANING. Remove any dirt and trash which has accumulated in the hot water distribution basins. Clean any nozzles that are clogged. Remove any sediment from the cold water basin, sump and screens. Use a water hose to flush cold water basins.

OPERATE WATER SYSTEM. Completely open all hot water flow control valves. Start the circulating water pumps. Increase the flow of circulating water gradually to design water rate to avoid surges or water hammer which could damage the distribution piping. Circulate water over the tower continuously for several days before starting the mechanical equipment and putting the tower into continuous operation.

INSPECTION. It is imperative that all operating assemblies be inspected before they are placed in operation. Following is a list of components to be checked before starting the tower:

1. Check drive shaft alignment. Realign if necessary. See Marley Drive Shaft Service Manual.
2. Check tightness of bolts that attach steel mechanical equipment support to the tower framing. Check tightness of bolts in fan cylinder joints and fan cylinder anchorage. Do not pull washers into the wood.
3. Check tightness of bolts at diagonals and columns, and at girts and columns in the area between fan and cold water basin.
4. Check tightness of the following bolted joints in the fan and drive assemblies:
   (a) Fan hub clamp bolts (see Marley Fan Service Manual for correct torque setting).
   (b) Fan hub cover bolts.
   (c) Geareducer and motor mounting bolts.
   (d) Drive shaft coupling and guard bolts.
5. Check Geareducer oil for sludge or water by draining off and testing a sample, as outlined in the Geareducer Service Manual. *Check Geareducer oil level at "oil level" mark on the side of the case. Add oil as required. The oil level placard must be adjusted so its "full" mark is at the same elevation as the "full" mark on the side of the Geareducer case. Check oil lines to be sure there are no leaks and all joints are tight.* See Geareducer Service Manual for oil filling procedure and list of recommended lubricants.
6. Rotate fan by hand to be sure of free rotation and ample tip clearance. See Fan Service Manual.
7. Check motor insulation with a "Megger". See Maintenance section of Marley Service Manual on Electric Motors.
8. *Lubricate the motor according to motor manufacturer's instructions.*
9. Test run each fan separately for a short time. Check for excessive vibration or unusual noise. If either is present, see Tower Trouble Tips on pages 8 and 9 of this manual. Fan must rotate clockwise when viewed from above. Recheck Geareducer oil level.
10. Check functioning of make-up water supply.
11. Make sure the blowdown or bleed-off will carry the proper amount of water.

STARTING PROCEDURE

FILLING THE WATER SYSTEM. Fill the cold water basin and circulating water system until the operating water level is reached. See Operation section, page 4.

Completely open all hot water flow control valves; then prime and start the circulating water pumps. Increase the flow of circulating water gradually to design water rate to avoid surges or water hammer which could damage the distribution piping. Adjust valves to equalize the hot water depth in the distribution basins. Lock valves in desired open position with valve locking bar.

On towers equipped with redwood stave distribution piping, some seepage at edge joints may occur during pre-start up and in the initial stages of operation. After the first two weeks of continuous operation, check tightness of nuts securing GRP pipe bands on the redwood stave pipe. Nuts should be snug. Do not over-tighten.

Clean the sump screens several times during the first weeks of operation. After this, clean sump screens as required.

STARTING THE FAN. Start the fan. After 30 minutes operating time to permit Geareducer oil to come up to

operating temperature, check motor load with watt meter, or take operating volt and ampere readings and calculate motor HP. Refer to Marley Fan Service Manual for instructions. Pitch fans to pull correct contract horsepower when circulating design water rate at design hot water temperature.

OPERATION

TOWER PERFORMANCE. Keep the tower clean and the water distribution uniform to obtain continued maximum cooling capacity. Do not allow excessive deposits of scale or algae to build up on the filling or eliminators. Keep the metering orifices free of debris to assure correct distribution and cooling of water.

The capacity of a tower to cool water to a given cold water temperature varies with the wet-bulb temperature* and the heat load on the tower. As the wet-bulb temperature drops, the cold water temperature also drops. However, the cold water temperature does not drop as much as the wet-bulb temperature.

A tower does not control the heat load. The quantity of water circulated determines the cooling range** for a given heat load. The hot and cold water temperature increases with higher heat loads.

COLD WATER COLLECTING BASIN. The normal water depth in a wood basin is 5 to 8 inches, while in a concrete basin, the normal water level is 9 to 15 inches below the curb. Adjust the make-up water supply to maintain this water level. Low operating depths of the water require air baffles under the fill to prevent air bypass. Maintain sufficient water depth to prevent cavitation.

HOT WATER DISTRIBUTION SYSTEM. Keep metering orifices clean and in place in distribution basins. Adjust water flow to give the same depth in the distribution basins of all cells. Design water depth varies from 4" to 7" depending upon design circulating water rate. If a major change in the quantity of water to be circulated over the tower is to be made, replace the removable metering orifices with ones of the new correct orifice size to provide adequate water break-up and maintain the proper water level.

If an Amertap condenser tube cleaning system is part of plant equipment, care should be taken during operation to back-wash the strainer section only after the sponge rubber cleaning balls are removed from the system by trapping them in the collector. If the balls are allowed to enter the cooling tower supply piping, they can clog the plastic metering orifices. Clogged orifices will cause unequal water distribution over the fill which will affect thermal performance. Extensive clogging can lead to overflowing the distribution basins and possible ice damage to towers installed in freezing climates. The basins should be frequently checked for orifice clogging until such time as the operational sequence of the Amertap system assures that no balls enter the cooling tower piping.

FAN DRIVE. If a two-speed motor is used, *allow a time delay of a minimum of 20 seconds after de-energizing the high speed winding and before energizing the low speed winding.* Tremendous stresses are placed on driven machinery and motor unless the motor is allowed to slow to low speed rpm or less before the low speed winding is energized. *When changing fan direction of rotation, allow a minimum of two minutes time delay before energizing the fan motor.*

WINTER OPERATION. During periods of low temperature operation, 35° to 40°F or below, ice will form on the relatively dry parts of the tower that are in contact with the incoming air. Primarily, this includes the louvers and adjacent structural framing.

Ice forming characteristics on any given tower will vary, depending on velocity and direction of wind, circulating water rate and heat load. Excessive ice formation may be controlled by regulating air and water flow through the tower by one or more of the following procedures:

1. Shut the fan down. This reduces the cooling rate to a minimum and increases the quantity of warm water on the louvers to a maximum. Except for extreme cold conditions or extended freezing conditions, this procedure will normally control ice formation. For automatic operation, a timer switch can be provided to shut the fan down for a few minutes each hour.
2. If the tower has two-speed motors, operate the fan at half speed forward. This reduces the cooling rate (heat transfer) and increases the quantity of warm water on the louvers.
3. Under extended extreme cold conditions, it may be necessary to operate the fan in reverse. This forces warm air out through the louvers, melting any accumulated ice. Reversal may be at either full or half speed, however, full speed is recommended if adequate heat load is available. Reverse operation of the fan should only be used to control ice, not prevent it. *Reverse fan operation should not exceed 15 to 20 minutes.* Usually much less time than this is required to melt accumulated ice.
4. With no heat load on the circulating water, icing can not be controlled effectively by air control during freezing weather. Towers must not be operated with reduced water rate and/or no heat load during freezing weather. If a by-pass directly into the cold water basin is used, all water must be by-passed. Design of a by-pass arrangement must include consideration of water impact effect on tower components.

CAUTION: Severely Cold Weather – Below 20°F. Ambient Dry Bulb – Reverse operation of fans for prolonged periods during sub-freezing weather can cause severe damage to fans and fan cylinders. Ice can accumulate inside fan cylinders at fan blade plane of rotation and fan blade tips will eventually strike this ring of ice, damaging the fan blades or cylinder. Ice can also accumulate on fan blades and be thrown off, damaging fan cylinder or blades. Reverse oper-

*Wet-bulb temperature – the temperature indicated by the wet-bulb thermometer of a sling or mechanically aspirated psychrometer.

**Cooling range – the temperature difference between the hot water coming into the cooling tower and the cold water leaving the tower.

ation of fans with adjacent fans not operating increases probability of icing. The low discharge velocity of moist air from fan cylinders in which fans are not in operation can result in moisture ladened air being pulled into the adjacent cylinder in which the fan is operating in reverse, increasing this ice build-up. Therefore, fans each side of the one operating in reverse must be operated in forward rotation at full or half speed, or all fans must be operated in reverse. Allow a minimum of 10 minute delay between reverse operation and forward operation during sub-freezing weather to permit ice to dissipate from fan blades and fan cylinders.

See "Fan Drive" for fan speed change and reversing precautions.

UNIT MAINTENANCE

Well maintained equipment gives the best operating results and the least maintenance cost. Marley recommends setting up a regular inspection schedule to insure effective safe operation of the cooling tower. Use the schedule in Table I to obtain continuously good performance with least tower maintenance. See Cooling Tower Inspection Check List in this manual. Keep a continuous lubrication and maintenance record for each cooling tower. Regular inspection and repair of personnel safety items, indicated by an asterisk in Table I, and a record of same is especially important. "SAFETY FIRST". For a supply of check list forms, contact your Marley sales office or representative.

HOT WATER DISTRIBUTION BASINS. Metering orifices in the floor of the hot water basins may be cleaned without shutting down any part of the tower. Remove dirt, algae, leaves, etc., which might get in these basins or orifices. The metering orifices must be kept in place to assure proper water distribution.

Completely open and close flow control valves at least semi annually to remove any scale on the threads. Before operating valve, measure distance from valve stem guide to operating handle to assist in resetting the valve to the original operating position. Grease the stainless steel stem to prevent scale forming. Lubricate the valves at least semi-annually with a lithium base NLGI No. 2 consistency grease. More frequent relubrication of valves and valve stems may be dictated by circulating water conditions.

TABLE I

INSPECTION & MAINTENANCE SCHEDULE

General Recommendations

(More frequent inspection and maintenance may be desirable)

	FAN & FAN GUARD	MOTOR	DRIVESHAFT & GUARDS	GEAREDUCER	ELIMINATOR	FILL	COLD WATER BASIN	HOT WATER BASIN	FLOAT VALVE	SUCTION SCREEN	CONTROL VALVES	STRUCTURAL MEMBERS	CASING	FAN CYLINDER	STAIRS, LADDERS, WALKWAYS, DOORS, HANDRAILS*	DAVITS, DERRICKS, HOISTS*
1. Inspect for clogging					M	M		W		W						
2. Check for unusual noise or vibration	D	D	D	D												
3. Inspect keys, keyways and set screws	S	S	S	S												
4. Make sure vents are open				S												
5. Lubricate (grease)		R									S					
6. Check oil seals				M												
7. Check operating oil level				D												
8. Check static oil level				M												
9. Check oil for water and sludge				M												
10. Change oil, at least				S												
11. Check fan blade tip clearance	S															
12. Check water level							D	D								
13. Check for leakage				W			S	S	S							
14. Inspect general condition	S	S	S	S	Y	S	Y	S	Y	S	S	S	Y	S	S	S
15. Tighten loose bolts	S	S	S	S								Y	R	S		
16. Clean	R	R	R	R	R	R	S	R	R	R	R					
17. Repaint	R	R	R	R												
18. Rebalance	R		R													
19. Completely open and close											S					
*20. Inspect/repair for safe use	Y		Y												Y	
*21. Inspect and repair before each use																R

D - daily; W - weekly; M - monthly; Q - quarterly; S - semi-annually; Y - yearly; R - as required

COLD WATER COLLECTING BASIN. Inspect collecting basin occasionally for leaks and repair if necessary. Minor leaks may appear in redwood basins when starting with a dry basin but these generally disappear after the wood becomes soaked. Keep cold water outlets clean and free of debris. Make-up and circulating water controls must operate freely and maintain the desired water quantity in the system.

TOWER FRAMEWORK. Keep framework bolts tight. Pay particular attention to bolts in the mechanical equipment supports. Do not pull washers into the wood.

DRIVE SHAFT. Check drive shaft alignment and condition of couplings every six months. See the Drive Shaft Service Manual for correcting misalignment, balancing or replacing parts.

ELECTRIC MOTOR. Lubricate and maintain each electric motor in accordance with the manufacturer's instructions. If repair work is necessary, contact the nearest representative of the motor manufacturer. See Warranty Section of Marley Service Manual on Electric Motors.

FAN. Inspect fan blade surfaces every six months. For detailed maintenance information, refer to Marley Fan Service Manual.

GEAREDUCER. Make weekly and monthly oil checks. Inspect internal parts during seasonal oil change. Refer to the Geareducer Service Manual for detailed maintenance instructions.

PAINTING. Periodically clean and, if necessary, recoat all metal parts subject to corrosion.

COOLING TOWER WOOD DETERIORATION. Cooling tower wood is pressure treated to help prevent decay. However, after several years of service, an occasional member may develop decay. Routine inspections should be made to assure that decay is discovered before it is heavily advanced.

Decay is commonly of two very general types, soft rot and internal rot. Soft rot is easier to detect because it is almost always on the surface of wood members. It makes the surface soft and weak and in its more advanced stages the decayed wood can be easily removed. This type of rot occurs primarily in the flooded areas of the tower. Internal rot, as the name implies, occurs inside the wood members. For this reason it is more difficult to detect than is soft rot. Internal rot is most commonly found in the heavier members in the plenum areas of the tower. One of the best methods of inspection for internal rot is "sounding" with hammer blows. Members which have internal rot sound "dead" while non-rotted members have a "ring" or "live" sound. Areas which sound "dead" can be probed with a screwdriver or other pointed tool to verify the presence of internal rot. The strength of a member with soft rot is not seriously affected, however, if internal rot is discovered, the infected members should be replaced.

Marley maintains a laboratory for detailed wood inspections and has personnel on its staff experienced in all aspects of wood deterioration and preservative treatment. In addition, several Marley publications are available which give detailed information on the subject of wood deterioration and treatment. Contact the nearest Marley sales office or representative for more information about wood inspection services and for copies of the publications.

WATER TREATMENT

BLOWDOWN. Blowdown, or bleed-off, is the continuous removal of a portion of the water from the circulating system. Blowdown is used to prevent the dissolved solids from concentrating to the point where they will form scale. The amount of blowdown required depends upon the cooling range (the difference between the hot and cold water temperatures) and the composition of the make-up water (water added to the system to compensate for losses by blowdown, evaporation and drift). The following table shows the amount of blowdown required to maintain different concentrations with various cooling ranges:

Blowdown – % of Circulating Rate

COOLING	CONCENTRATIONS						
RANGE °F	1.5X	2.0X	2.5X	3.0X	4.0X	5.0X	6.0X
5	.78	.38	.25	.18	.11	.08	.06
10	1.58	.78	.51	.38	.25	.18	.14
15	2.38	1.18	.78	.58	.38	.28	.22
20	3.18	1.58	1.05	.78	.51	.38	.30
25	3.98	1.98	1.32	.98	.64	.48	.38

EXAMPLE: 7000 GPM circulating rate, 15° cooling range. To maintain 4 concentrations, the required blowdown is .38% or .0038 times 7000 GPM which is 26.6 GPM.

If tower is operated at 4 concentrations, circulating water will contain four times as much dissolved solid as the makeup water, providing none of the solids form scale or are otherwise removed from the system.

CHEMICAL TREATMENT. In some cases chemical treatment of the circulating water is not required if adequate blowdown is maintained. In most cases, however, chemical treatment is required to prevent scale formation and corrosion. Sulfuric acid or one of the polyphosphates is most generally used to control calcium carbonate scale. Various proprietary materials containing chromates, phosphates or other compounds are available for corrosion control. When water treatment chemicals are required, the services of reliable water treating companies should be obtained.

Slime, a gelatinous organic growth, and algae, a green moss-like growth, may grow in the cooling tower or heat exchanger. Their presence can interfere with cooling efficiencies. Proprietary compounds are available from water treating companies for the control of slime and/or algae, however, compounds which contain soluble copper must be used with care. Copper can accelerate corrosion of steel, iron, aluminum and galvanizing and should not be used in systems containing any of those materials. Chlorine and chlorine containing compounds are effective algaecides and slimicides but excess chlorine can damage wood and other organic materials of construction. If used, chlorine should be added as intermittent (or shock) treatment only as frequently as needed to control the slime and algae, and free

residual levels should not exceed one part per million parts water (1 ppm). Chlorine or chlorine containing compounds should be added carefully since very high levels of chlorine may occur at or near the point of entry into the circulating water system.

FOAMING. Heavy foaming sometimes occurs when a new tower is put into operation. This type of foaming generally subsides after a relatively short period of operation. Persistent foaming can be caused by the concentrations of certain combinations of dissolved solids or by contamination of the circulating water with foam-causing compounds. This type of foaming can sometimes be minimized by increasing the blowdown, but in some cases foam depressant chemicals must be added to the system. Foam depressants are available from a number of chemical companies.

WATER DISCOLORATION. Woods contain some water soluble substances and these commonly discolor the circulating water on a new tower. This discoloration is not harmful to any of the components in the system and can be ignored. However, a combination of foaming and discolored water can result in staining of adjacent structures if foam is picked up by air being pulled through the tower and discharged out the fan cylinders. Avoid operation of fans until the foaming is controlled.

SPARE PARTS

Marley maintains a stock of replacement parts for mechanical equipment. Shipment of these parts is normally made within ten days after an order is received. If emergency service is necessary, contact the local Marley sales office or representative for assistance.

To prevent prolonged shutdown periods in case of damage to the mechanical equipment, it is suggested that the following parts be carried in the owner's stock:

1. One fan assembly.
2. One Geareducer assembly.
3. One drive shaft assembly.

Be sure to furnish the tower serial number when ordering any parts.

SEASONAL SHUTDOWN INSTRUCTIONS

BASIN AND FRAME

Drain the tower basins and all exposed piping. Leave the cold water basin drain open. Water may be left in wood cold water basin if tower is located in a non-freezing area.

During shutdown, clean the tower and make any necessary repairs. Apply protective coating as required to all metal parts. Particular attention should be given to mechanical equipment supports, drive shaft and drive shaft guards. Inspect visually for wood deterioration and test members for soft spots.

Protect wood towers against fire. If tower is wetted for fire protection, wet it down continuously; alternate wetting and drying is destructive to wood. CAUTION: If ambient temperature is 32 degrees or below, do not put cold water on tower.

MECHANICAL EQUIPMENT

Flow Control Valve

Grease valve threads at zerk fitting using rust inhibiting lithium base grease of NLGI No. 2 consistency and then open valve. Coat exposed valve stem with grease.

Geareducers (3 months or less shut down)

1. Each month, drain water condensate from the lowest point of the Geareducer and its oil system. Check oil level and add oil if necessary. Operate to re-coat all interior surfaces with oil.
2. At start-up, drain water condensate and check oil level. Add oil if necessary.

Refer to Geareducer service manual for maintenance and lubrication instructions.

3 Months or More Shutdown

If motors have space heaters, operate mechanical equipment one hour each month. Space heaters should be energized anytime motor is not operating. If motors do not have space heaters, operate mechanical equipment one hour each week. At start-up, operate mechanical equipment one hour or until oil is warm, then shut the equipment down. Drain the oil and refill with new oil. Refer to Geareducer Manual for instructions on changing oil.

Electric Motors

Do not start motor without determining that there will be no interference with free rotation of the fan drive.

Refer to motor manufacturer's recommendations for lubrication and maintenance instructions.

If shutdown period is longer than seasonal, contact your Marley sales office or representative for additional information.

TOWER TROUBLE TIPS

TROUBLE	CAUSE	REMEDY
Motor Will Not Start	Power not available at motor terminals	1. Check power at starter. Correct any bad connections between the control apparatus and the motor. 2. Check starter contacts and control circuit. Reset overloads, close contacts, reset tripped switches or replace failed control switches. 3. If power is not on all leads at starter make sure overload and short circuit devices are in proper condition.
	Wrong connections	Check motor and control connections against wiring diagrams.
	Low voltage	Check nameplate voltage against power supply. Check voltage at motor terminals.
	Open circuit in motor winding	Check stator windings for open circuits.
	Motor or fan drive stuck	Disconnect motor from load and check motor and Geareducer for cause of problem.
	Rotor defective	Look for broken bars or rings.
Unusual Motor Noise	Motor running single-phase	Stop motor and attempt to start it. Motor will not start if single-phased. Check wiring, controls and motor.
	Motor leads connected incorrectly	Check motor connections against wiring diagram on motor.
	Ball bearings	Check lubrication. Replace bad bearings.
	Electrical unbalance	Check voltages and currents of all three lines. Correct if required.
	Air gap not uniform	Check and correct bracket fits or bearing.
	Rotor unbalance	Rebalance.
	Cooling fan hitting guard	Reinstall or replace fan.
Motor Runs Hot	Wrong voltage or unbalanced voltage	Check voltage and current of all three lines against nameplate values.
	Overload	Check fan blade pitch. See Fan Service Manual. Check for drag in fan drive train as from damaged bearings.
	Wrong motor rpm	Check nameplate against power supply. Check rpm of motor and gear ratio.
	Bearings overgreased	Remove grease reliefs. Run motor up to speed to purge excessive grease.
	Rotor rubs stator bore	If not poor machining, replace worn bearing.
	Wrong lubricant in bearings	Change to proper lubricant. See motor manufacturer's instructions.
	One phase open	Stop motor and attempt to start it. Motor will not start if single-phased. Check wiring, controls and motor.
	Poor ventilation	Clean motor and check ventilation openings. Allow ample ventilation around motor.
	Winding fault	Check with Ohmmeter.

TOWER TROUBLE TIPS

TROUBLE	CAUSE	REMEDY
Motor Runs Hot (continued)	Bent motor shaft	Straighten or replace shaft.
	Insufficient grease	Remove plugs and regrease bearings.
	Deterioration of or foreign material in grease	Flush bearings and relubricate.
	Bearings damaged	Replace bearings.
	Incorrect fan blade pitch	See Fan Service Manual for blade pitching instructions.
Motor Does Not Come Up To Speed	Voltage too low at motor terminals because of line drop	Check transformer and setting of taps. Use higher voltage on transformer terminals or reduce loads. Increase wire size or reduce inertia.
	Broken rotor bars	Look for cracks near the rings. A new rotor may be required. Have motor service man check motor.
Wrong Rotation (Motor)	Wrong sequence of phases	Change any two of the three motor leads.
Geareducer Noise	Geareducer bearings	If new, see if noise disappears after one week of operation. Drain, flush and refill Geareducer. See Geareducer Service Manual. If still noisy, replace.
	Gears	Correct tooth engagement. Replace badly worn gears. Replace gears with imperfect tooth spacing or form.
Unusual Fan Drive Vibration	Loose bolts and cap screws	Tighten all bolts and cap screws on all mechanical equipment and supports.
	Unbalanced drive shaft or worn couplings	Make sure motor and Geareducer shafts are in proper alignment and "match marks" properly matched. Repair or replace worn couplings. Rebalance drive shaft by adding or removing weights from balancing cap screws. See Drive Shaft Service Manual.
	Fan	Be sure blades are properly positioned in correct sockets. Check match numbers. Make certain all blades are as far from center of fan as safety devices permit. All blades must be pitched the same. See Fan Service Manual. Clean off deposit build-up on blades.
	Worn Geareducer bearings	Check fan and pinion shaft endplay. Replace bearings as necessary.
	Unbalanced motor	Disconnect load and operate motor. If motor still vibrates, rebalance rotor.
	Bent Geareducer shaft	Check fan and pinion shafts with dial indicator. Replace if necessary.
Fan Noise	Loose fan hub cover	Tighten hub cover fasteners.
	Blade rubbing inside of fan cylinder	Adjust cylinder to provide blade tip clearance.
	Loose bolts in blade clamps	Check and tighten if necessary.

MARLEY

COOLING TOWER INSPECTION CHECK LIST

ORIGINAL

Route to:

Owner _____ Date Inspected _____

Plant _____ Inspected By _____

Location _____ Tower Manufacturer _____

Owner Designation _____ Installed _____ 19 _____

Water Treatment Used _____ Model No. _____

Design Conditions _____ GPM _____ HW _____ CW _____ WB

Condition: 1 - Good; 2 - Repair; 3 - Replace	*1*	*2*	*3*
EXTERIOR STRUCTURE:			
1. Endwall Casing & Access Doors			
2. Louvers ( )			
3. Drain Boards			
4. Stairway			
5. Fan Deck			
6. Fan Deck Supports			
7. Handrails			
8. Ladders & Walkways			
9. Distribution System			
Headers (Type)			
Distribution Basin			
Water Level			
Flow Control Valves (Size)			
Nozzles (Size)			
Water Distribution			
10. Spray System & Spray Nozzles			
11. Fan Cylinders (Type)			
INTERIOR STRUCTURE:			
12. Fill (Type)			
13. Columns			
14. Girts			
15. Diagonals			
16. Partitions & Doors			
17. Eliminators (Type)			
18. Walkway			
19. Cold Water Basin (Type)			
Water Depth			
20. Mech. Equip. Support (Type)			

Condition: 1 - Good; 2 - Repair; 3 - Replace	*1*	*2*	*3*
MECHANICAL EQUIPMENT			
21. Drive Shafts (Type)			
22. Speed Reducer			
Series _____ Ratio _____			
Oil Level			
Oil Seals			
Vent			
Back Lash			
Pinion Shaft Play			
Fan Shaft End Play			
Last Oil Change (Date)			
Oil Used			
23. Fans			
Dia. _____ Type _____			
Hub			
Blades			
Hub Cover			
Tip Clearance			
No Vibration _____ Vibration _____			
Additional Components (If installed on tower)			
Fan Guards			
Oil Gauge & Drain Lines			
Vibration Limit Switches			
Other:			
24. Motor: Mfr.			
Name Plate _____ HP _____ RPM			
Phase _____ Cycle _____ Volts _____			
Amperes _____ Frame _____			

REPLACEMENT PARTS REQUIRED:

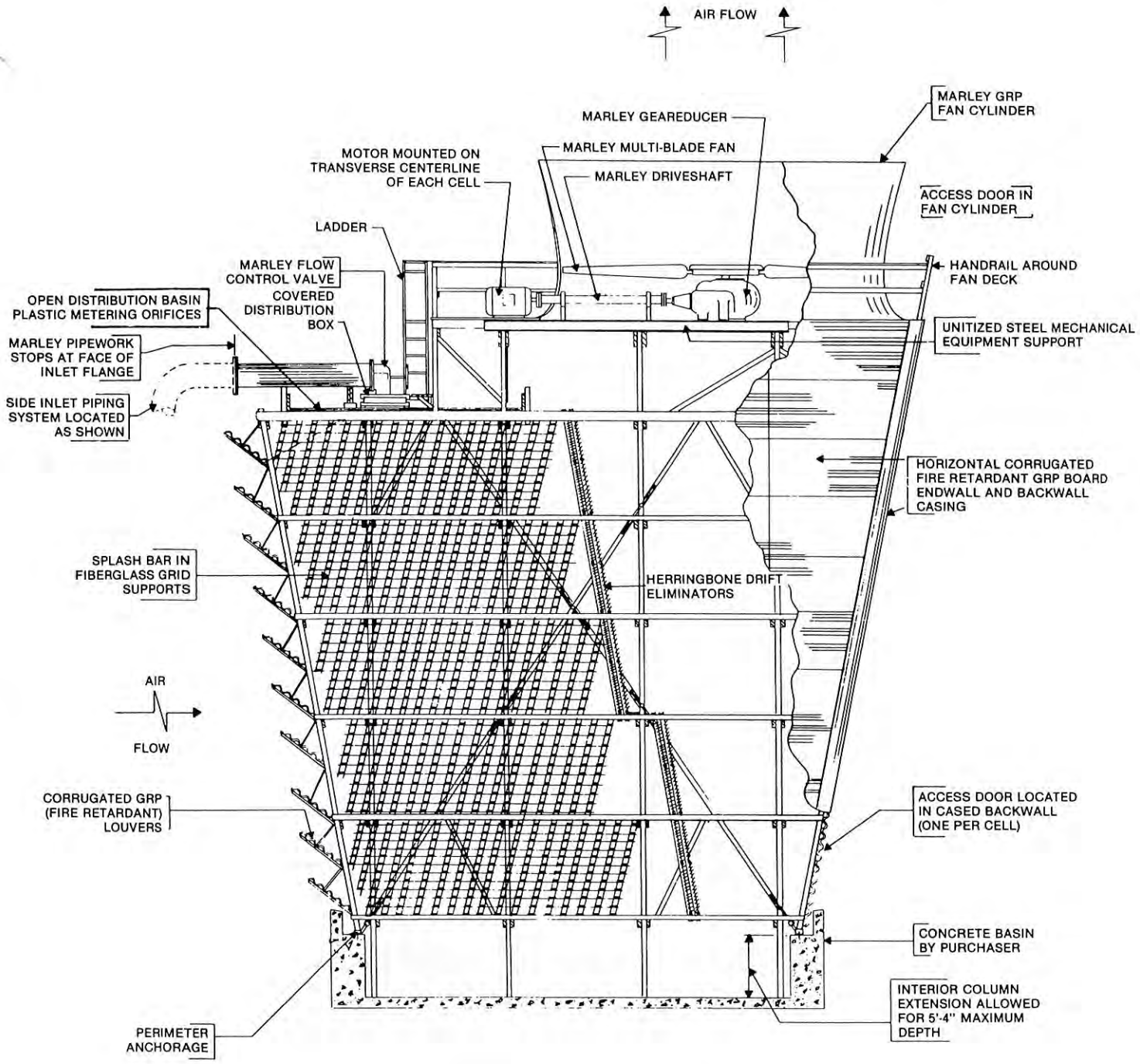
QUANTITY	DESCRIPTION	ORDER FROM	DATE REQ'D

MAINTENANCE WORK REQUIRED:

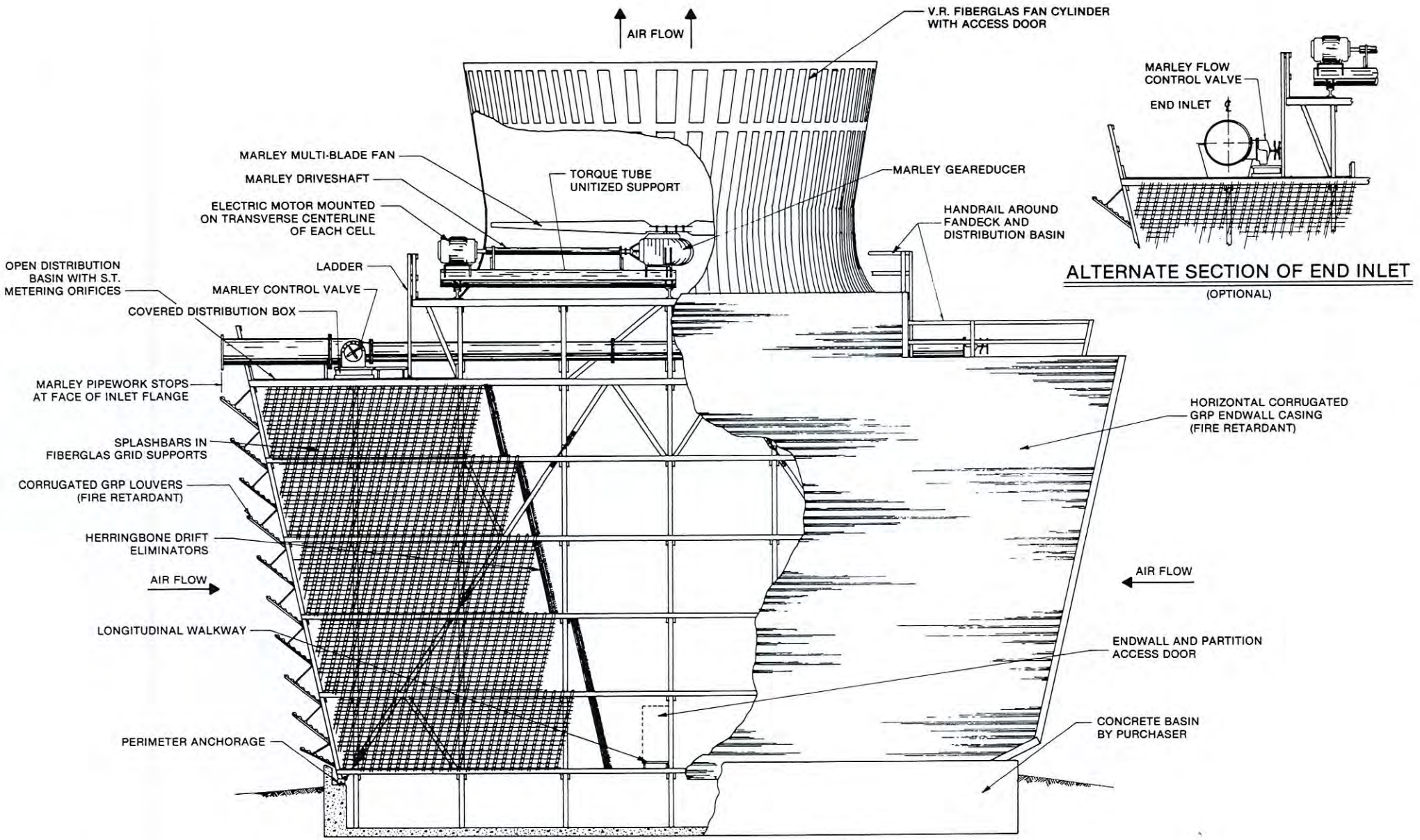
DESCRIPTION	REQ'D COMPLETION

(Use back of this sheet for additional requirements or notes.)

CS–2066



TRANSVERSE CROSS SECTION OF CLASS 600 SINGLE-FLOW TOWER



ALTERNATE SECTION OF END INLET

(OPTIONAL)

TRANSVERSE CROSS SECTION

MARLEY

MANUAL

Series 34.3T GEAREDUCERS®

●

Field Repair Instructions

DECEMBER, 1986

RM-34.3T-B

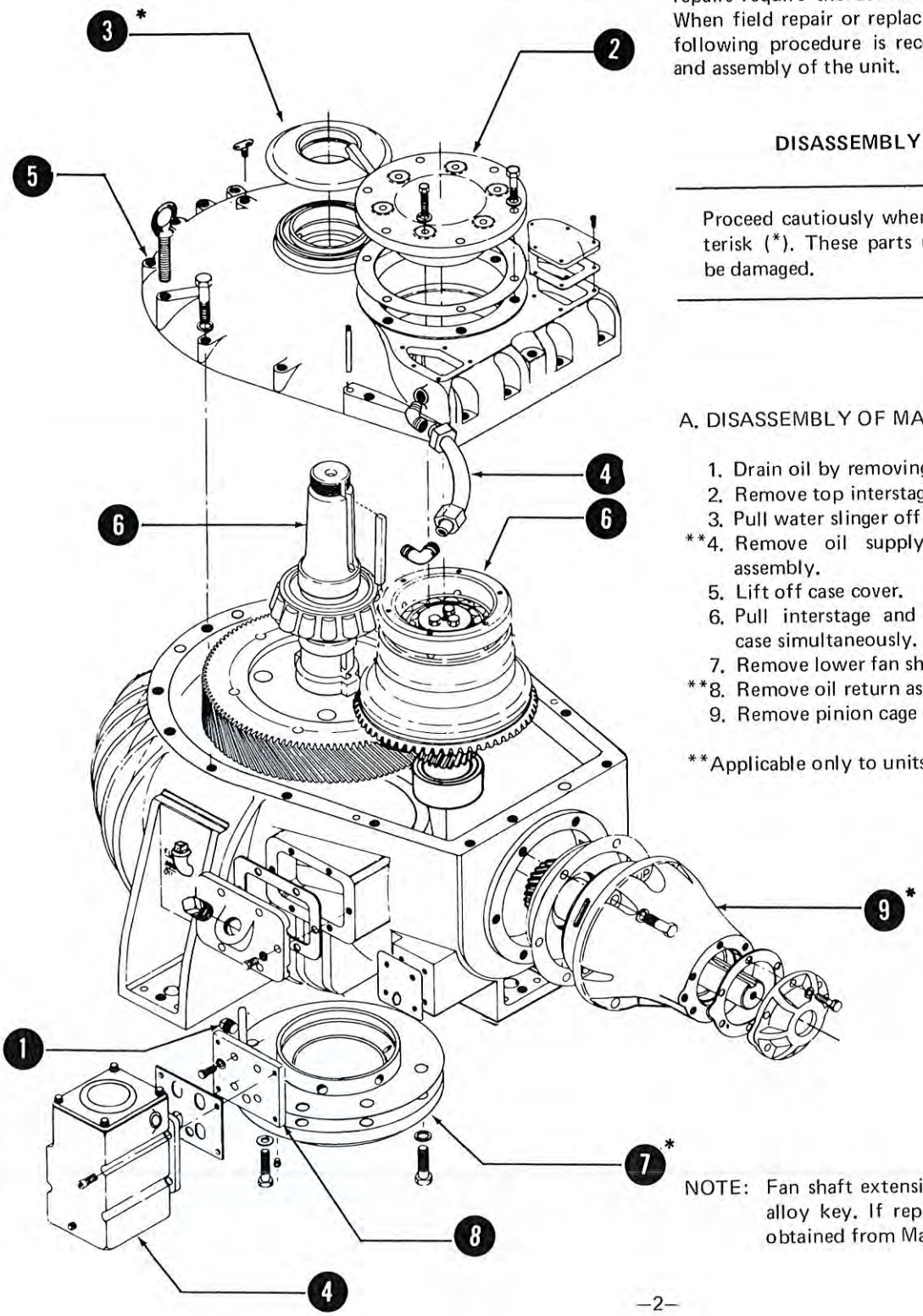
5800 Foxridge Drive – P.O. Box 2912 – Mission, Kansas 66201

PRINTED IN U.S.A.

MARLEY
SERIES 34.3T GEAREDUCERS
FIELD REPAIR INSTRUCTIONS

Marley recommends that Geareducers in need of extensive repair be returned to its plant at Olathe, Kansas, in exchange for a factory reconditioned unit. Obtain "Customer Return Material" tag from Marley sales office or representative to affix to the Geareducer for return. A factory reconditioned Geareducer carries the same one year guarantee against defect in material and workmanship as does a new unit.

Geareducers can be repaired in the field, however, major repairs require the use of a fully equipped machine shop. When field repair or replacement of parts is necessary, the following procedure is recommended for the disassembly and assembly of the unit.



DISASSEMBLY OF GEAREDUCER

Proceed cautiously when removing parts noted by asterisk (*). These parts use oil seals which must not be damaged.

A. DISASSEMBLY OF MAJOR SUBASSEMBLIES

1. Drain oil by removing drain plug.
2. Remove top interstage cap.
3. Pull water slinger off fan shaft.*

**4. Remove oil supply tube, plugs, and filter case assembly.

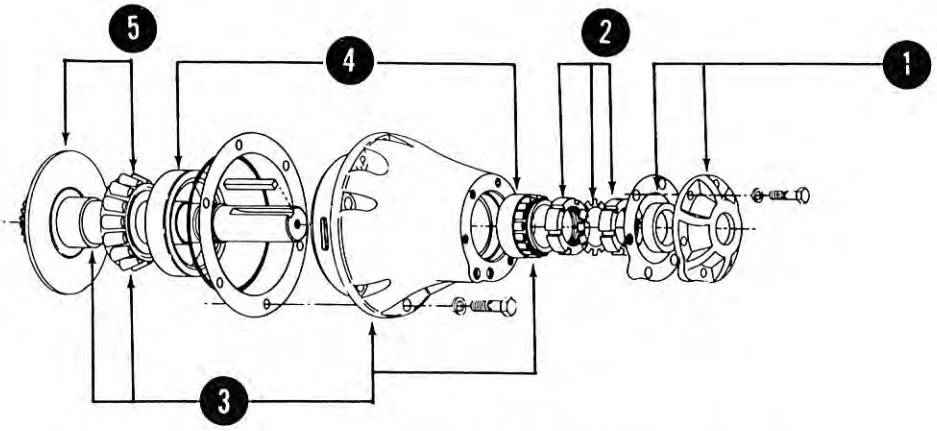
5. Lift off case cover.
6. Pull interstage and fan shaft subassemblies out of case simultaneously.
7. Remove lower fan shaft cap.*

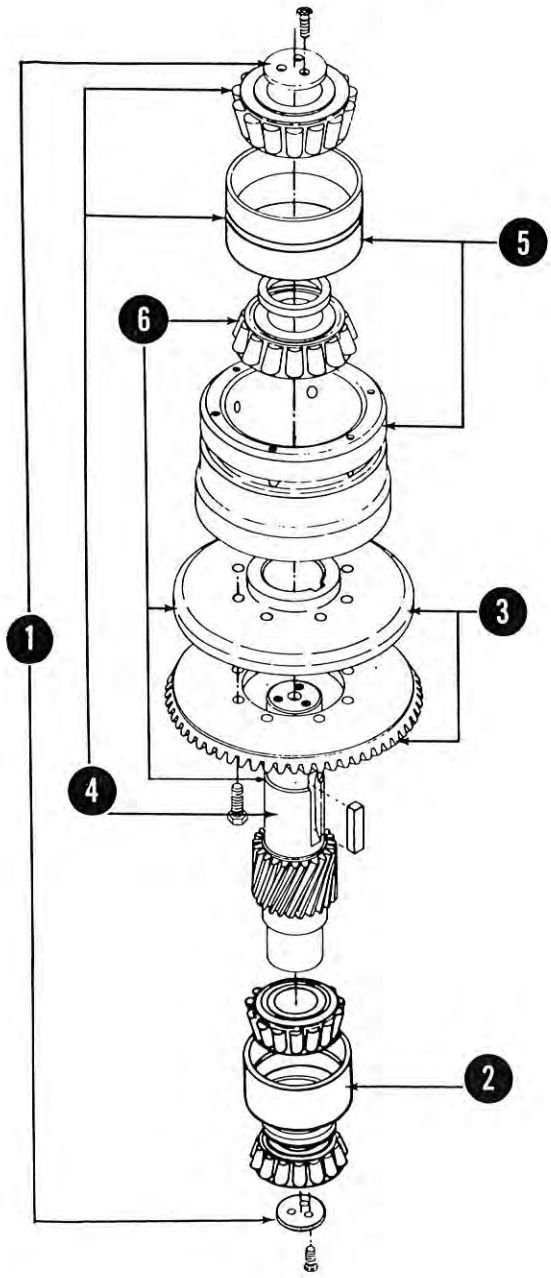
**8. Remove oil return assembly.

9. Remove pinion cage subassembly.*

**Applicable only to units having oil filters.

NOTE: Fan shaft extension key is a high strength, special alloy key. If replacement is required, it must be obtained from Marley.





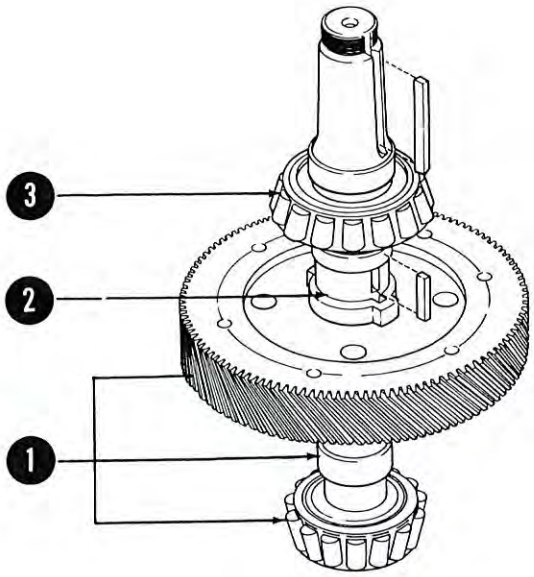
▲ B. DISASSEMBLY OF PINION CAGE

1. Remove pinion cage cap.* Be especially careful to avoid damaging oil seal.
2. Remove locknuts and washer from pinion shaft.
3. Press pinion shaft with head bearing cone out of pinion cage. (This will free cone of tail bearing.)
4. Remove bearing cups from pinion cage.
5. If bearing cone on head of pinion shaft is to be replaced, it can be removed by pressing off oil slinger.

◀ C. DISASSEMBLY OF INTERSTAGE

1. Remove top and bottom interstage bearing discs.
2. Pull bottom bearing, two cones with spacer and one cup, from shaft.
3. Remove spiral bevel ring gear from hub.
4. Push shaft out of upper bearing cone, cup and retainer.
5. Pull upper bearing double cup from top interstage retainer.
6. Pull spiral bevel ring gear hub and bearing cone off shaft. Key between ring gear hub and interstage shaft is a high strength, special alloy key. If replacement is required, it must be obtained from Marley.

*See page 2.



◀ D. DISASSEMBLY OF FAN SHAFT

1. Press helical ring gear, lower fan shaft spacer and lower cone from shaft. Press against gear hub only, not against ring gear. Key between ring gear hub and fan shaft is a high strength, special alloy key. If replacement is required, it must be obtained from Marley.
2. Remove helical ring gear hub spacer.
3. Remove upper bearing cone and water slinger spacer.
4. Remove upper fan shaft bearing cup from case cover. (Not illustrated.)
5. Remove lower fan shaft bearing cup from case. (Not illustrated.)

ASSEMBLY OF GEAREDUCER

GEAR MATCH NUMBERS & SETTING DATA

Before assembling a new pinion gear in the pinion cage, check match numbers on pinion gear and spiral bevel ring gear to be certain that they are a matched set. Gears are lapped in matched sets at the factory and should not be separated. Numbers are etched on both the pinion and ring gear as illustrated in Fig. 1.

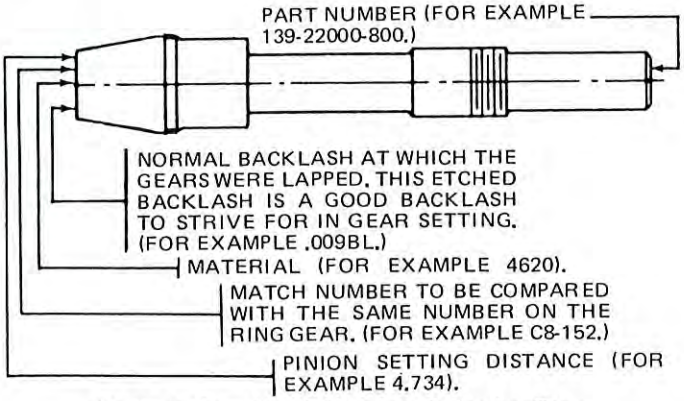
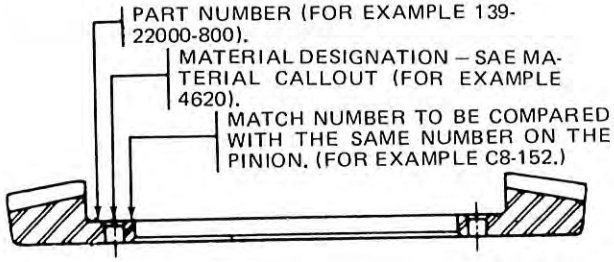
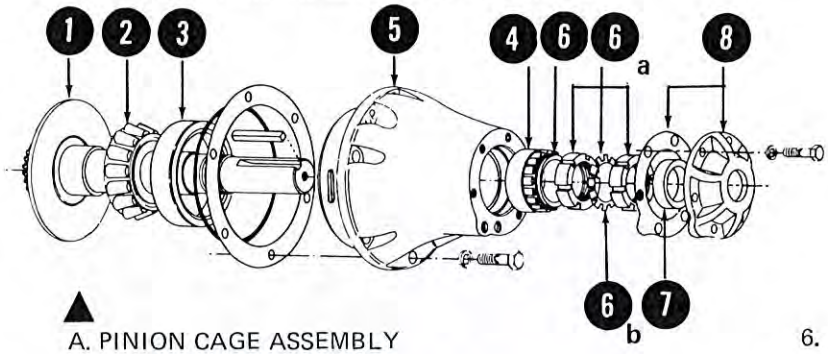


Figure 1. Gear Match Numbers & Setting Data



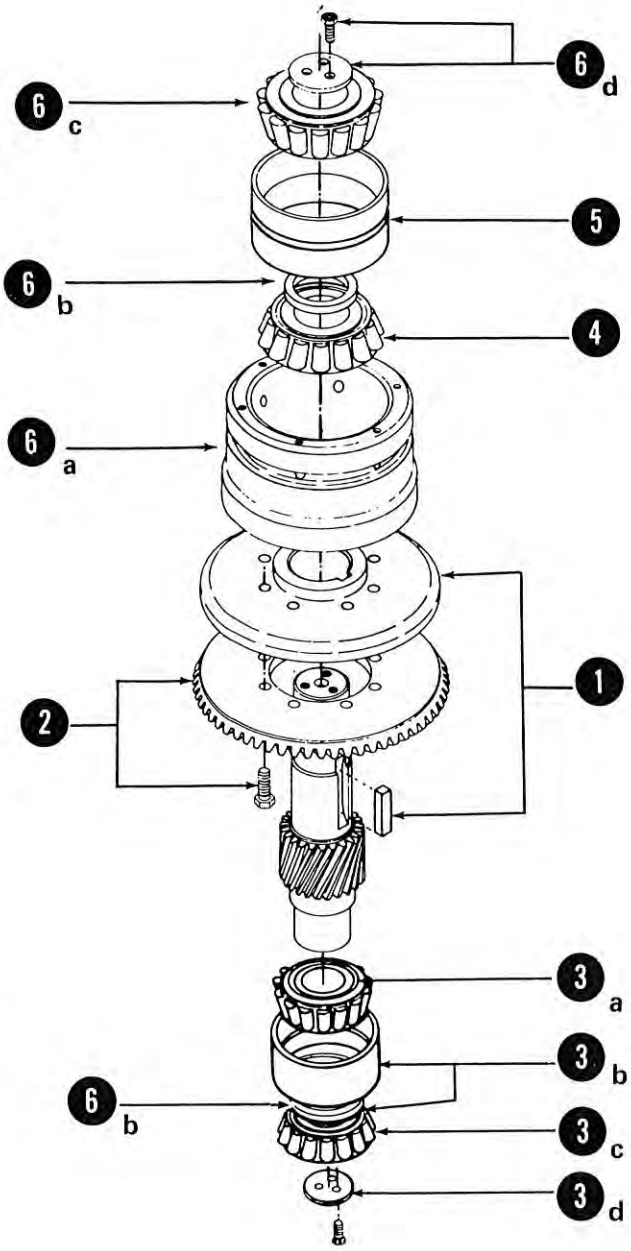
4.734 IS THE THEORETICAL PINION SETTING DISTANCE. THE ACTUAL PINION SETTING DISTANCE IS ETCHED ON THE END OF THIS PINION. THIS IS THE DISTANCE THE END OF THE PINION SHOULD BE FROM THE CENTER LINE OF THE RING GEAR SHAFT.



▲ A. PINION CAGE ASSEMBLY

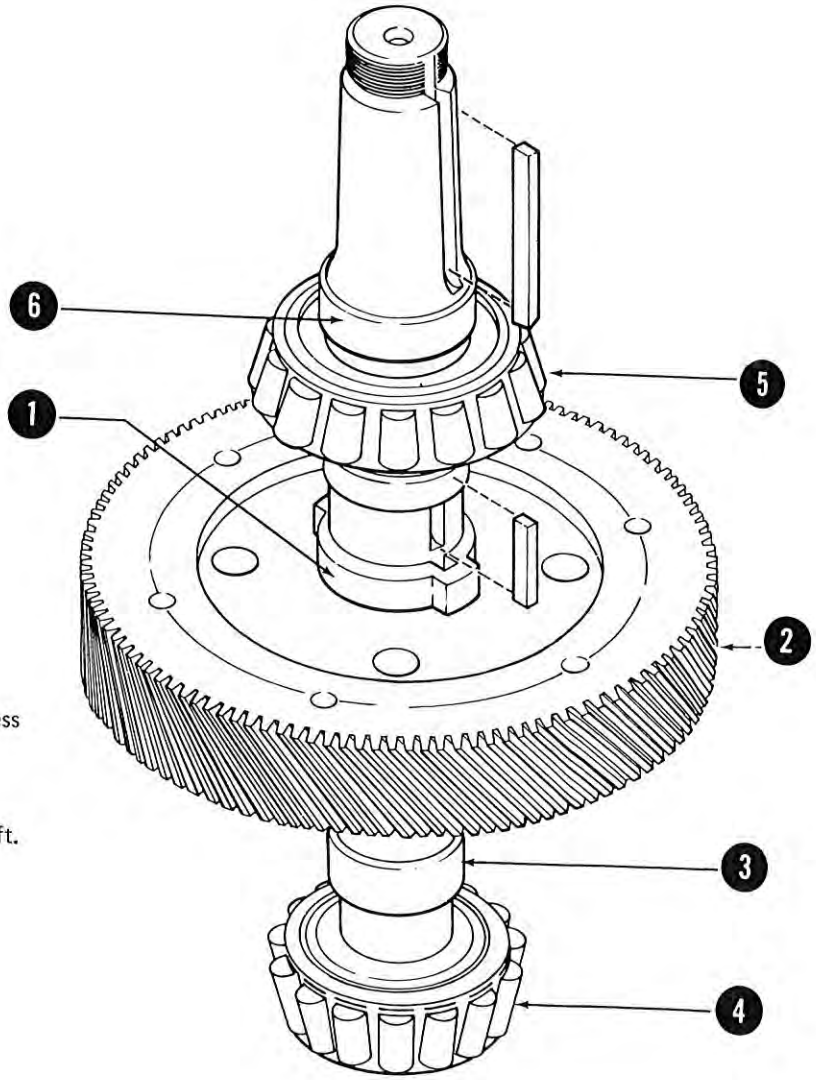
1. Press oil slinger onto pinion shaft.
2. Install pinion head bearing cone on pinion shaft pushing tight against shoulder.
3. Press pinion head bearing cup into pinion cage.
4. Press pinion tail bearing cup into pinion cage.
5. Lower pinion cage over pinion shaft until head bearing cone mates with cup.
6. Press tail bearing cone onto pinion shaft.
   (a) Lock with locknuts and lockwasher to provide a bearing preload of 10-18 inch pounds (resistance to rotation of pinion shaft).
   (b) Crimp ears of lockwasher to locknuts after obtaining proper preload.
7. Install pinion shaft oil seal* in pinion cage cap. (See Marley Oil Seal Manual.)
8. Assemble pinion cage cap and gasket to pinion cage.

*Marley recommends that new oil seals, "O" rings and gaskets be installed during a major overhaul. If oil seals, "O" rings or gaskets are to be reused, they should be carefully inspected for damage before being reinstalled.



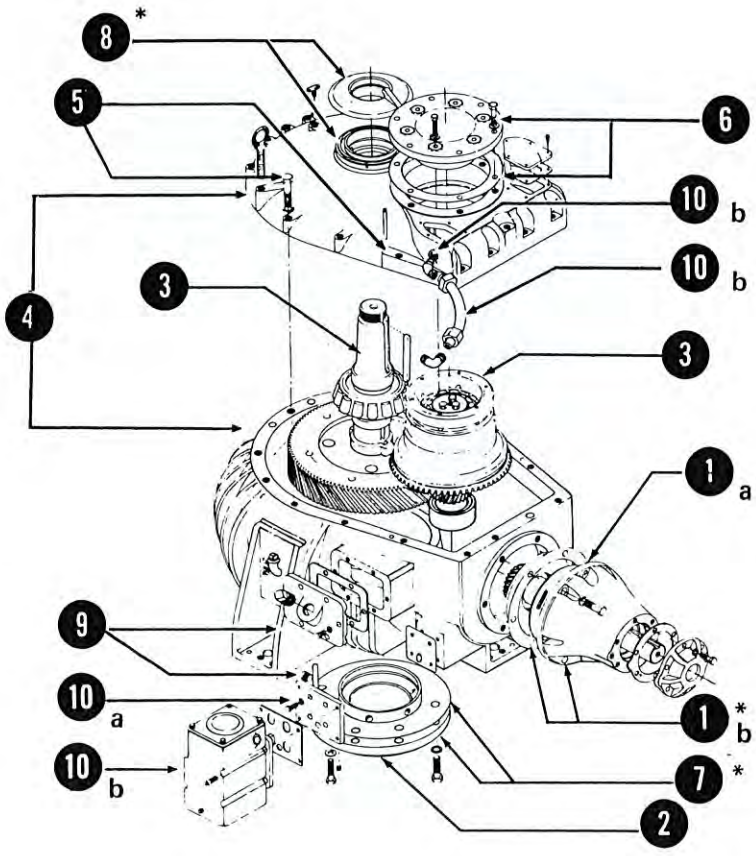
◀ B. INTERSTAGE ASSEMBLY

1. Install key and spiral bevel ring gear hub on interstage shaft.
2. Attach ring gear to ring gear hub with place bolts. (Tighten to 85-90 ft./lbs. torque.)
3. (a) Press top cone of bottom interstage bearing onto interstage shaft.
   (b) Install double cup and cone spacer of bottom interstage bearing.
   (c) Press bottom cone into place.
   (d) Install disc with place bolts. (Tighten to 50-55 ft./lbs. torque.)
4. Press bottom cone of top interstage bearing onto interstage shaft.
5. Install double cup of interstage bearing in retainer.
6. (a) Lower retainer and top interstage bearing cups onto interstage shaft until bottom cup and cone mate.
   (b) Place cone spacer on top of lower cone.
   (c) Press upper cone into place.
   (d) Install disc with place bolts. (Tighten to 50-55 ft./lbs. torque.)



C. FAN SHAFT ASSEMBLY ▶

1. Place ring gear spacer on fan shaft.
2. Install key and press helical gear on fan shaft. Press against gear hub only, not against ring gear.
3. Place lower bearing spacer on fan shaft.
4. Press bottom bearing cone onto fan shaft.
5. Press upper fan shaft bearing cone on fan shaft.
6. Install water slinger spacer.



*See page 2

D. CASE AND COVER ASSEMBLY
(Not illustrated)

1. (a) Install upper fan shaft bearing cup in case cover.
   (b) Install lower fan shaft bearing cup in case.

E. FINAL ASSEMBLY

1. (a) Install "O"-ring onto pinion cage subassembly.
   (b) Bolt pinion cage subassembly to case and cover subassembly using proper number of shims to give indicated pinion setting distance which is etched on front face of pinion gear. (See Fig. 1, page 4.)
2. Temporarily install lower fan shaft cap and secure to case with cap screws. Leave a minimum of 1/8" clearance between cap and case. Do not install "O" rings or shims at this time.
3. Lower fan shaft and interstage shaft subassemblies into case simultaneously.
   Engage marked spiral bevel ring gear teeth with marked spiral bevel pinion tooth.
4. Apply a coat of Permatex No. 2 to surface of case which mates with case cover.
   Lower case cover subassembly onto case, piloting both shaft subassemblies into their respective bores.
5. Install taper pins to align bearing bores. Fasten case cover to case with cap screws tightening to 35-45 ft./lbs. torque.
6. (a) Position top interstage cap shims and install cap with place bolts.
   (b) Adjust shims to give proper backlash (.006-.012 normal) between spiral bevel gears. See "GEAR SETTING PROCEDURE".
   (c) When proper backlash has been set, tighten place bolts to 85-90 ft./lbs. torque.
7. Fan shaft bearings must be preloaded to .000"-.002" in the following manner:
   (a) Assemble fan shaft subassembly in case-cover initially with a quantity of shims between case and bottom cap to insure that axial bearing end play exists.
   (b) Mount a dial indicator to measure axial movement of fan shaft. Support indicator stand on the cover or interstage cap adjacent to fan shaft and position indicator to read on machined face just under threaded extension.
   (c) Rotate fan shaft slowly in one direction until all downward movement stops. Rotation is necessary in order to align the bearing rollers and seat roller ends on cone lip. Record dial indicator reading.
   (d) Move shaft in opposite axial direction by either lifting on shaft by attaching to the threaded extension with a swivel joint and hoist or by turning Geareducer over allowing the weight of the shaft assembly to seat the bearings. If a hoist is used, lifting force should be 700 lbs. This is sufficient to overcome the weight of the fan shaft assembly. Rotate shaft slowly in one direction until all axial movement stops. Record dial indicator reading.
   (e) The difference in dial indicator readings (steps c & d) is the initial fan shaft bearing end play. In order to achieve the prescribed preload of .000" to .002", remove an amount of shims from between the case and bottom cap equal to the measured end play plus .000" to .002". For example, if the measured end play is .005", remove a total of .005" to .007" shim thickness.
   CAUTION: If Geareducer is in the upright position when bottom cap is removed, block under the ring gear to prevent gear from dropping down onto lower interstage bearing retainer (roller cage).
   (f) Install "O" ring in bottom cap and install bottom cap. Tighten cap screws to 75-80 ft./lbs. torque.
8. (a) Coat labyrinth recess in case cover with Permatex No. 2 and install labyrinth ring.
   (b) Fill grooves of labyrinth ring and water slinger with a lithium base grease of NLGI No. 2 consistency.
   (c) Install water slinger and its "O" ring on fan shaft.
9. Install inspection cover, gasket, and drain plug.
10. FOR INTEGRAL OIL FILTER
    (a) Install oil return assembly with gasket into case. If cap screws are black socket head, tighten them to 30-35 ft./lbs. torque. If stainless steel socket head cap screws are used, tighten them to 20 ft./lbs. torque.
    (b) Install oil filter case assembly. Tighten cap screws to 35-40 ft./lbs. torque. Install oil supply lines and fittings.
11. FOR ASSEMBLY WITHOUT OIL FILTER
    (Not illustrated)
    Install oil return cover with gasket. Install pipe plug in oil supply opening in case cover.

GEAR SETTING PROCEDURE

The proper mounting of the gear set is essential to obtain long life and smooth operation of the gears. The pinion cage position adjustment is obtained by shims under the flange of the pinion cage. Shims are placed under the top interstage bearing cap to adjust ring gear position. The gear setting may require several attempts before obtaining the proper backlash and tooth contact pattern.

The gear and pinion are match-marked when lapped and must be assembled the same way. The ring gear has the end of two teeth marked "X" and the pinion has one tooth so marked; the gears should be engaged with the X-marked pinion tooth between those marked on the ring gear. Match marks can be checked through the inspection opening.

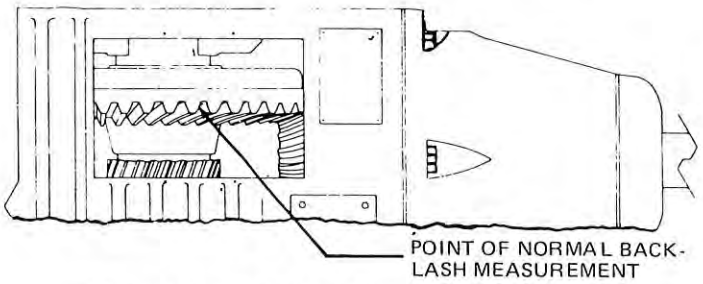


Figure 2. Gear Backlash Measurement

With the marked teeth of the gear engaged, check backlash with dial indicator (see Fig. 2). The indicator can be installed through the inspection cover opening. Change shims under top interstage bearing cap until backlash is between .006 to .012" normal to ring gear tooth.

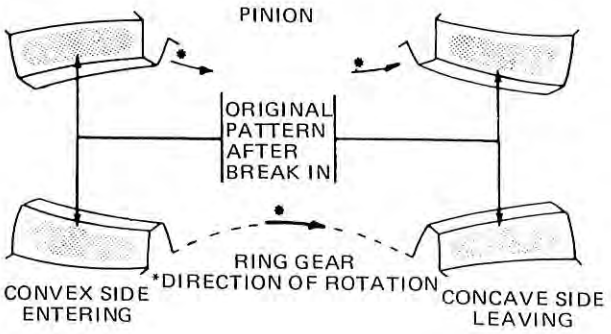
With gears adjusted for proper backlash, blue (Prussian Blue in oil) the gear teeth. Drive the pinion by turning ring gear in both directions for several revolutions. Observe the contact pattern on both gears on both sides of the teeth. The contact pattern should be as shown at the top of Fig. 3.

If correct tooth contact pattern is not obtained on first trial, refer to sketches at bottom of Fig. 3; these sketches show the two cases of "out-of-position contact" in the extreme. One of the remedies indicated will correct the out-of-position contact; compare the tooth contact pattern with sketches shown in Fig. 3, and choose the required remedy.

When proper tooth contact has been obtained, recheck the backlash at marked teeth. If it is within the desired range (.006" to .012"), check backlash with dial indicator at 2 additional points 120^{o} apart (with inspection cover removed), and as shown in Fig. 2. All backlash readings must be within the specified range. If backlash is not within the limits, adjust ring-gear height with shims until it is, checking again as described.

The tooth contact pattern should again be checked to determine if adjusting the backlash has produced any shift. If it has shifted, move the pinion in the opposite direction

CORRECT PINION & RING GEAR TOOTH CONTACT PATTERNS



INCORRECT RING GEAR TOOTH CONTACT PATTERN

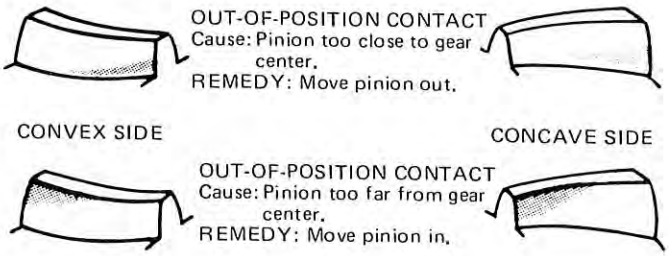


Figure 3. Tooth Contact Pattern, Correct and Incorrect.

the gear was moved with respect to the cone center. If the gear mounting distance is reduced, increase pinion setting distance, and vice versa, (see Fig. 1, page 4) an amount proportional to the number of teeth in the respective members. For example: on a 10 to 1 gear set, if the ring gear was moved 0.010", the pinion should be moved 0.001". This would be necessary only if the contact pattern had visually shifted due to movement of the ring gear while adjusting backlash.

When setting a used set of gears, follow the method outlined above. However, depending upon the amount of wear, it may be necessary to set the gears up with slightly greater backlash in order to obtain proper contact. Proper tooth contact pattern is the most important factor of correct installation.

Should a condition be encountered where correct contact cannot be obtained as described in this manual, the Geareducer should be returned to Marley's Olathe, Kansas plant in exchange for a factory reconditioned unit.

INSTALLATION AND LUBRICATION

The Geareducer must be installed level and properly aligned with the motor shaft. Connect drain line and vent line. Fill Geareducer with recommended oil (Table I) to full mark on case. Refer to Marley Geareducer and Drive shaft service manuals for complete instructions.

TABLE I

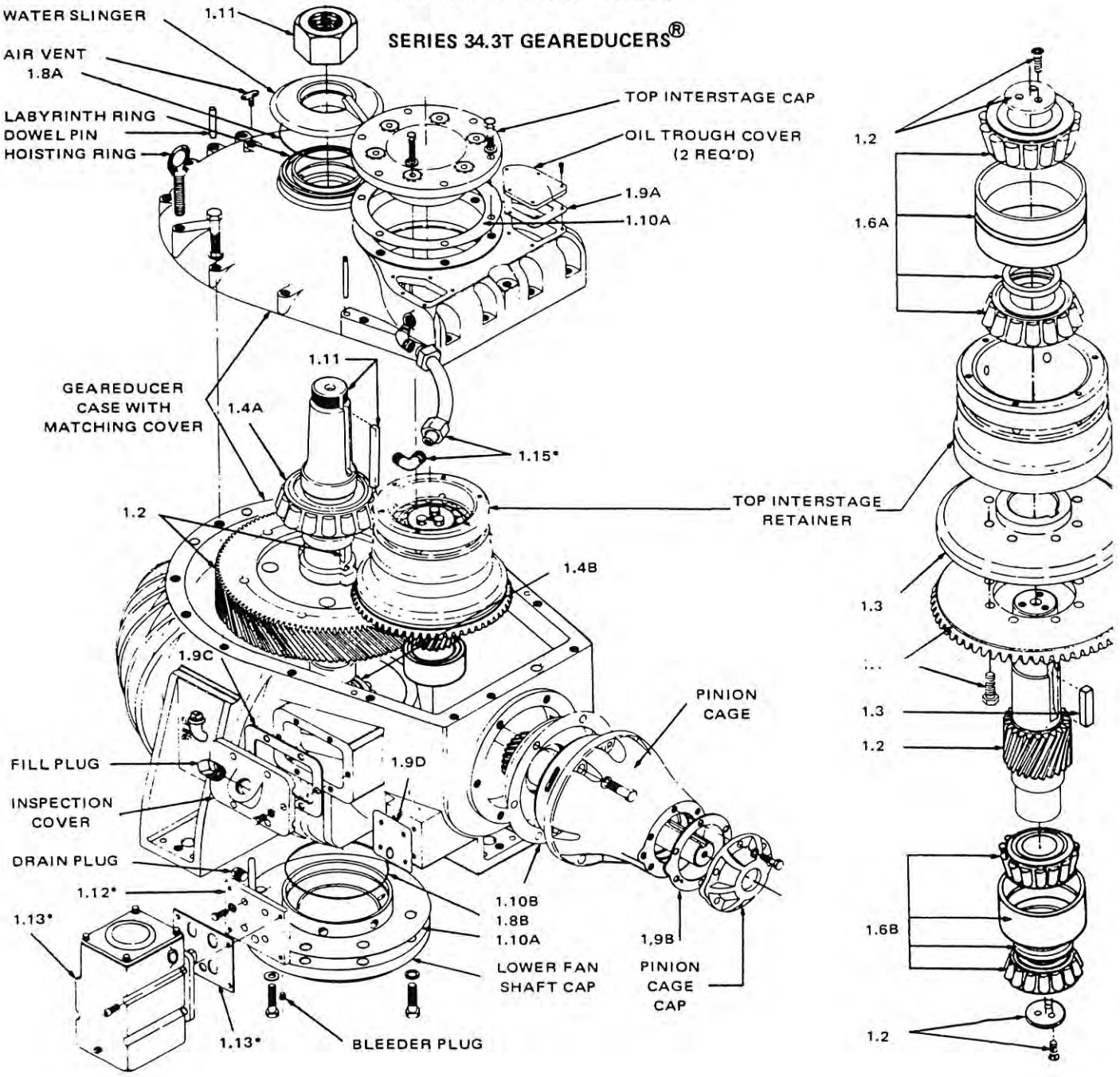
TURBINE TYPE MINERAL OILS FOR SPIRAL BEVEL GEAREDUCERS

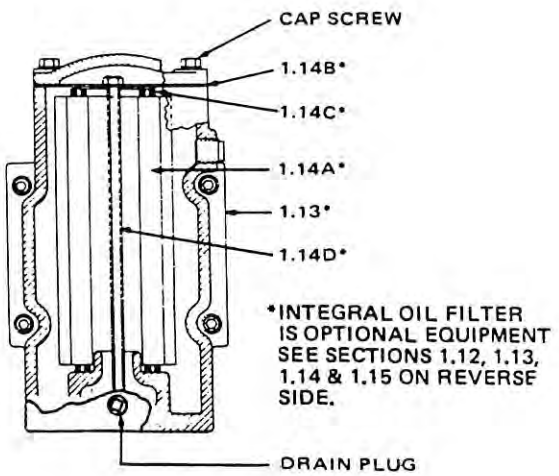
Listed below are typical turbine type mineral oils recommended for use in Marley Spiral Bevel Geareducers by the companies shown. Seasonal temperature changes require one viscosity of oil for summer operation and another for winter operation. If it is necessary to use any oil which is not listed in this table, that oil must not contain any additives which are adversely affected by moisture. The responsibility for use of lubricants other than those listed below lies with the customer/user and the lubricant supplier.

	AIR TEMPERATURE AT GEAREDUCER		
MANUFACTURER	**WINTER** Below 32°F **SAE 20** Viscosity S.U.S. At 100°F 230-310	**WINTER or SUMMER** 32°F to 110°F **SAE 30** Viscosity S.U.S. At 100°F 450-610	**SUMMER** Above 110°F **SAE 40** Viscosity S.U.S. At 100°F 750-1000
	LUBRICANT DESIGNATION		
American Oil Co.	American Ind. Oil No. 31	American Ind. Oil No. 51	American Ind. Oil No. 95
Ashland Pet. Co.	Ashland ETC Oil K-30	Ashland ETC Oil K-50	Ashland ETC Oil K-75
Atlantic Richfield Co. (ARCO)	Rubilene S-315	Rubilene 550	Rubilene S-700
Borne-Scrymser Co.	Turbo Gear Oil	Paragon Engine Oil	Bornes Motor Oil No. 50L
Chevron Oil Co.	Chevron OC Turbine Oil 68	Chevron OC Turbine Oil 150	Chevron OC Turbine Oil 220
Cities Service Co. (CITGO)	Citgo Pacemaker T-30	Citgo Pacemaker T-50	Citgo Pacemaker T-80
Continental Oil Co.	Dectol 33 R&O	Dectol 51 R&O	Dectol 76 R&O
Dryden Oil Co.	Sulgrave 2 Paradene 430	Sulgrave 3 Paradene 450	Sulgrave 4 Paradene 490
Exxon	Teresstic 68	Teresstic 100	Teresstic 150
Farmland Ind., Inc.	Co-op Indol 5	Co-op Indol 7	Co-op Indol 9
Gulf Oil Corp	Gulf Harmony 68	Gulf Harmony 115	Gulf Harmony 150
Imperial Oil, Ltd.	Teresso 52	Teresso 65	Teresso 85
Keystone Precision Lubricants	KLC No. 5	KLC No. 4	KLC No. 3
Lion Oil Co.	Azalea T-2 Azalea C	Azalea T-3 Azalea D	Azalea T-4 Azalea E
Mobil Oil Corp	DTE 26	DTE Ex. Hvy.	DTE BB
National Ref. Co.	Enarco ETC Oil K30	Enarco ETC Oil K50	Enarco ETC Oil K75
Pennzoil Co.	Hyd. Oil No. 3	Hyd. Oil No. 5	Hyd. Oil No. 7
Phillips Petroleum Co.	Magnus 315	Magnus 465	Magnus 700
Shell Oil Co.	Shell Turbo-68	Shell Turbo-150	Shell Turbo-220
Skelly Oil Co.	Skelvis SAE 20	Skelvis SAE 30	Skelvis SAE 50
Standard Oil of Indiana	Amer. Ind. Oil No. 31	Amer. Ind. Oil No. 51	Amer. Ind. Oil No. 95
Standard Oil of Ohio	Factovis 52	Factovis 65	Factovis 80
Sun Oil Co.	Sunvis 931 Sun R&O 300	Sunvis 951 Sun R&O 500	Sunvis 999 Sun R&O 950
Sunray DX Oil Co.	562	563	564
The Texas Co. (TEXACO)	Regal Oil N-68 (R&O)	Regal Oil N-150 (R&O)	Regal Oil N-220 (R&O)
Tidewater Oil Co.	Veedol Aturbrio 60	Veedol Aturbrio 71	Veedol Aturbrio 77
Union Oil of Calif. (East)	UNAX RX 315	UNAX RX 465	UNAX RX 700
Union Oil of Calif. (West)	Turbine Oil 315	Turbine Oil 465	Turbine Oil 1000
Valvoline Oil Co.	Valvoline ETC Oil K-30	Valvoline ETC Oil K-50	Valvoline ETC Oil K-75

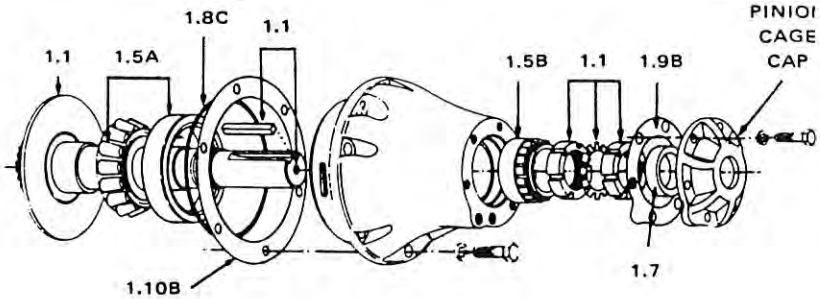
PARTS MANUAL SHEET

SERIES 34.3T GEAREDUCERS®





*INTEGRAL OIL FILTER IS OPTIONAL EQUIPMENT SEE SECTIONS 1.12, 1.13, 1.14 & 1.15 ON REVERSE SIDE.



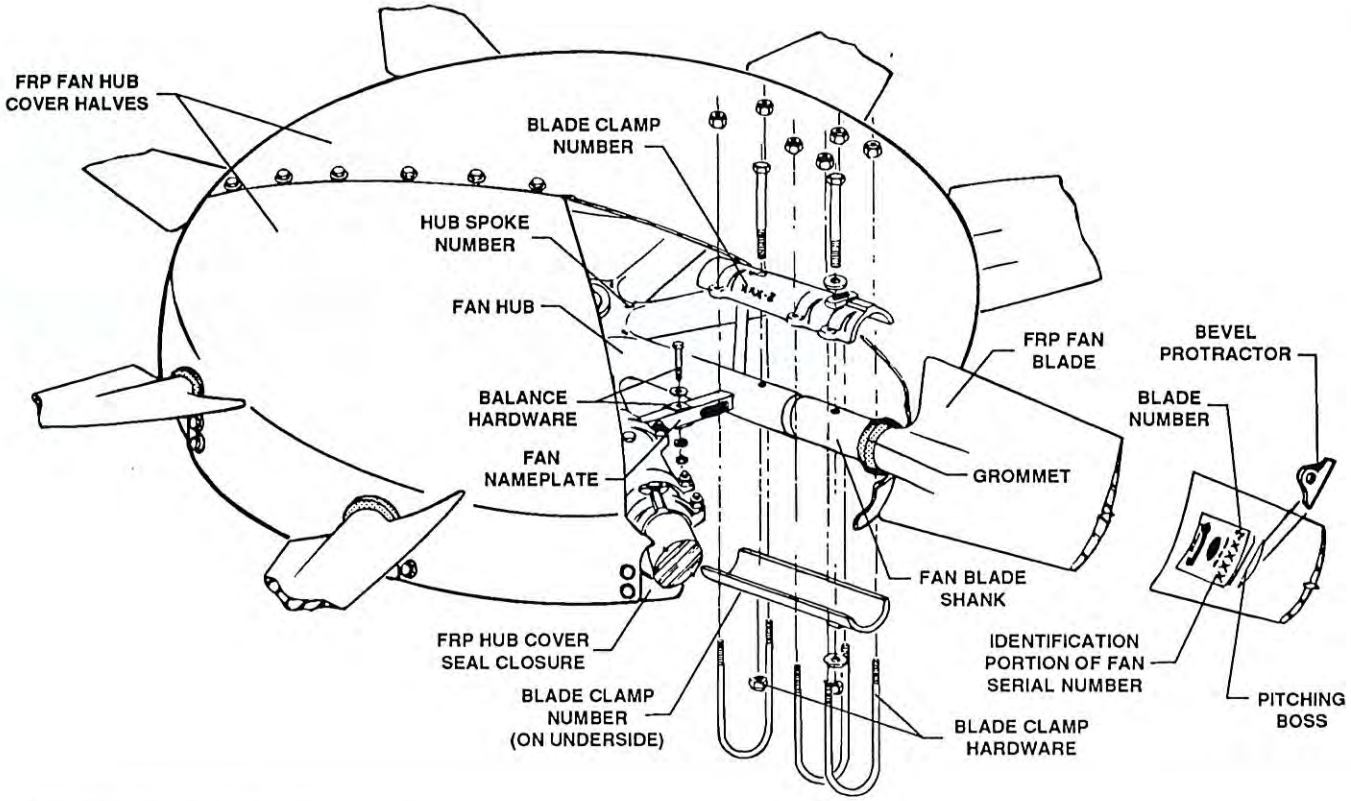
HP4 Fan
Service Manual

289" through 336" Diameter—8 Blades

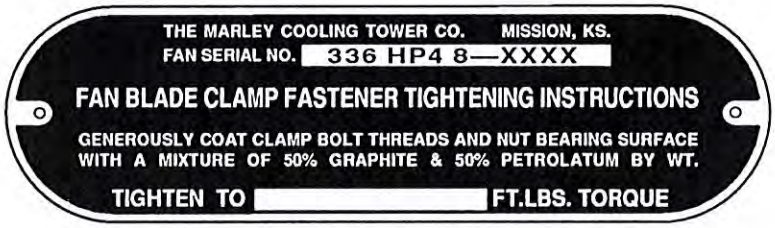
SERVICE MANUAL — HP4-289"—336"-8 BLADES

SM-HP4-8-289-336B 3/92

MARLEY



Fan Assembly



FAN NAMEPLATE

Marley Order No. _____
Trial Pitch Angle _____
Final Pitch Angle _____
Speed-rpm _____
Contract hp _____

△ Note

Each fan is statically balanced at the factory as an assembly. The fan hub is identified with the complete serial number and each hub spoke is identified by number. Each fan blade and blade clamp is marked with the identification portion of the fan serial number and a sequential number indicating position of the fan blade and blade clamp in the fan hub.

Fan Assembly

1—Make certain that the identification number on each blade corresponds with the identification number on the fan serial number nameplate.

2—U-bolt and machine bolt threads and washer face of lock nuts are lubricated at the factory prior to shipment. Touch up all threads with a generous coating of lubricant supplied with the fan assembly.

3—Blade and clamps marked No. 1 correspond with the No. 1 spoke on the fan hub and so on. Fan must be assembled in this order.

4—There is an arrow on each fan blade showing direction of fan rotation. This arrow must be on the air discharge side (top) of the fan.

△ **Note**

5—Be certain that each blade is as far from the center of the fan as the thru-bolts in the blade shank and hub spoke will permit. This is necessary in order to maintain proper balance.

6—Support blade tips in a horizontal plane when U-bolts are tightened. Hold each blade at the proper pitch angle when tightening.

7—Total vertical tip track variation should not exceed 2 inches (± 1 inch from the reference plane of fan rotation). Excessive tip track will cause dynamic imbalance.

Setting Fan Blade Pitch

1—The trial pitch angle is the calculated setting for design conditions (water rate, heat load, air density, and contract horsepower). Set the bevel protractor at the trial pitch angle (page 2) and pitch all the blades to the same angle. All blades must be pitched to the same angle with each blade pointing in the same direction in the fan cylinder.

2—Tighten the thru-bolt and U-bolt self locking nuts to 70 ft./lbs. (95Nm) torque. Tighten to 120 ft./lbs. (163 Nm) if hardware is stainless steel.

3—Recheck the pitch of each blade and adjust if required.

Fan Assembly Using HP4 (SMC) Replacement Blades

1—When installing replacement blades, even numbers of blades should be installed in pairs opposite each other within the fan assembly.

—continues

Odd numbers of blades will require that the blades and additional balance weight (if required) be installed as specified by Marley if fan balance is to be maintained.

2—During reassembly, make sure that the blade clamps and spoke numbers match (clamps marked No. 1 are used on spoke marked No. 1, etc.). Generously lubricate U-bolt and thru-bolt threads and washer face of lock nuts with a 50% by-weight mixture of petrolatum and graphite.

3—There is an arrow on each fan blade showing direction of fan rotation. This arrow must be on the air discharge side (top) of the fan.

△ **Note**

4—Be certain that each blade is as far from the center of the fan as the thru-bolts in the blade shank and hub spoke will permit. This is necessary in order to maintain proper balance.

5—Total vertical tip track variation should not exceed 2 inches (± 1 inch from the reference plane of fan rotation). Excessive tip track will cause dynamic imbalance.

Setting Fan Blade Pitch—HP4 (SMC) Replacement Blade

1—The blade pitch is set 69" from the inside edge of the fan blade. Place a bevel protractor on top of a parallel-sided straight edge that extends the full width of the blade. See **Figures 1** and **2**. Support the blade at the tip to maintain the proper rotational plane and hold the proper pitch angle when tightening the blade clamp hardware.

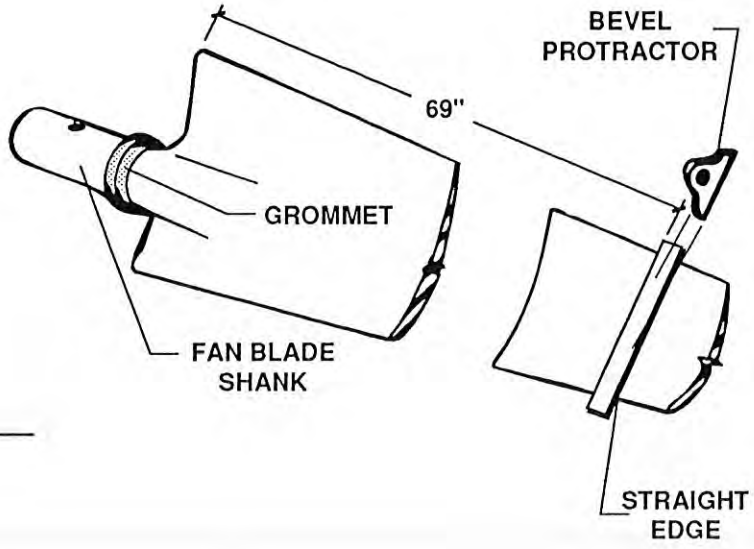


Figure 1

2—Set the bevel protractor at the specified trial pitch angle supplied (page 2) and pitch all the blades to the same angle. The trial blade pitch angle is the calculated setting for rated design conditions. Water rate, heat load and/or air density other than rated design conditions can vary the brake horsepower of the fan.

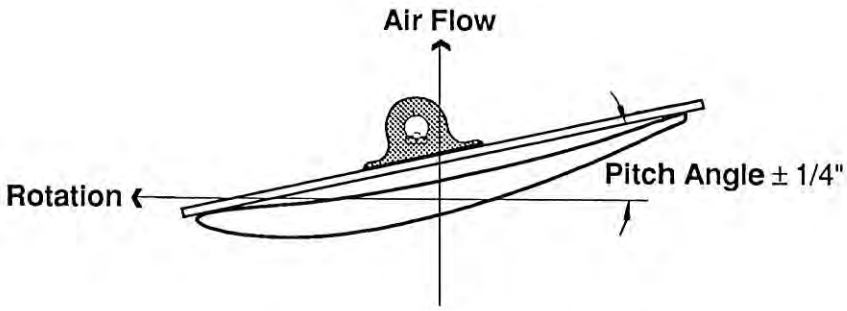


Figure 2

3—Tighten the thru-bolt and U-bolt self locking nuts to 70 ft./lbs. (95Nm) torque. Tighten to 120 ft./lbs. (163 Nm) if hardware is stainless steel.

4—Recheck the pitch of each blade and adjust if required.

Hub Cover Installation

1—Bolt hub cover halves together as shown in **Figure 3.** Tighten nuts to 10-15 ft./lbs. (14-20 Nm) torque.

2—Install hub cover subassembly on hub, attaching it to neoprene grommets.

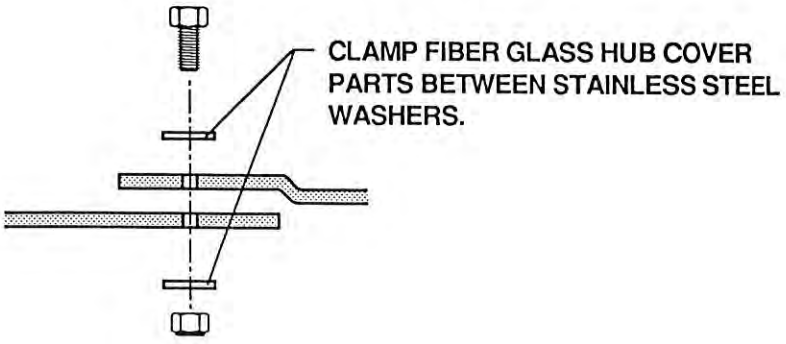


Figure 3

3—Install seal closures as shown on page 2. Tighten nuts to 10-15 ft./lbs. (14-20 Nm) torque.

Checking Load at Motor

1— Operate the fan until motor and Geareducer have reached operating temperature (approximately 30 minutes). Take operating voltage and amperage measurements for use in calculating motor HP by the following equation:

$$HP_A = \frac{VOLTS_A \times AMPS_A}{VOLTS_N \times AMPS_N} \times HP_N$$

HP_A = Actual Horsepower
$VOLTS_A$ = Actual Volts
$AMPS_A$ = Actual Amperage
$VOLTS_N$ = Nameplate Volts
$AMPS_N$ = Nameplate Amperage
HP_N = Nameplate Horsepower

△ **Note**

When checking and/or changing blade pitch or cycling fan in normal operation, do not exceed 30 sec./hour total motor starting time as motor may become overheated.

2—The calculated horsepower should equal but not exceed the specified contract horsepower. Measurements used in above calculations must be made with hot water flowing through the tower. Re-pitch blades as required to obtain contract horsepower. Measurements made with no water or cold water will result in an erroneous calculated horsepower.

3—A one-degree change in blade pitch will vary the power (HP) required by these values:

POWER VARIATION AT GEAREDUCER RATIO								
GRDR.	MOTOR SPEED	13.00/1	11.55/1	11.18/1	10.83/1	10.28/1	9.64/1	8.85/1
34.3T	1200	2.3	—	4.3	—	7.1	—	9.8
	1500	7.1	—	9.8	—	—	—	—
	1800	10.0	—	—	—	—	—	—
36	1200	—	3.5	—	6.0	—	8.3	—
	1500	7.1	9.6	—	11.9	—	—	—
	1800	11.9	—	—	—	—	—	—

4—If blades are re-pitched, self locking nuts must be retightened to 70 ft./lbs. torque (120 ft./lbs. if stainless steel).

Fan Rebalance

1—Replacement blades can be installed requiring only minimal field rebalancing. When ordering a replacement blade, give the fan serial number and blade number so that the balancing moment of the new blade can be matched to the recorded moment of the original blade.

2—If rebalance is required, trial and error attachment of balance weights to selected hub spoke braces may produce a satisfactory dynamic balance with the fan operating on the tower. If this is not satisfactory, it is recommended that the complete fan assembly be returned to the Marley factory located in Olathe, Kansas for selection of replacement parts and factory rebalance. Obtain "Customer Return Material" tag from a Marley sales office or representative in your area. If return of the parts is not practical, the fan assembly can be statically rebalanced as follows:

A—Fan assembly should be mounted on a suitable mandrel matching the hub bore, and the mandrel placed on knife wheels or level, parallel bars with the fan blades in a vertical plane. This must be done in a draft-free area.

B—Apply balance weights to selected spoke braces until all tendency for fan to rotate is overcome. This is accomplished by allowing the fan assembly to rotate freely on the knives until it comes to rest with the heaviest portion at the bottom. Manually rotate the fan 90° so that the heaviest portion is at either side of the fan center line. Add weights to the spoke brace on the light side of the hub.

C—If one or more blades are replaced, relocating some of the blades in other hub spokes may simplify balance and result in fewer balance weights being required.

Fan Maintenance

1—Check and, if necessary, retighten blade clamping hardware to prescribed torque after the first week of operation and subsequently at 6-month intervals. This should be done at the time the Geareducer oil is changed.

2—A monthly inspection of the fan should be made to assure continued trouble-free operation. Any accumulation of dirt or scale deposits on the fan should be carefully and completely removed if there are any indications of balance being affected. Preventive maintenance to control corrosive attack will prolong the useful life of the fan.

—continues

3—If it is necessary to disassemble the fan for any reason, blade clamp bolt threads and nut bearing surfaces must be recoated with lubricant consisting of 50% petrolatum and 50% graphite by weight and tightened to the torque limits shown.

Mechanical Service

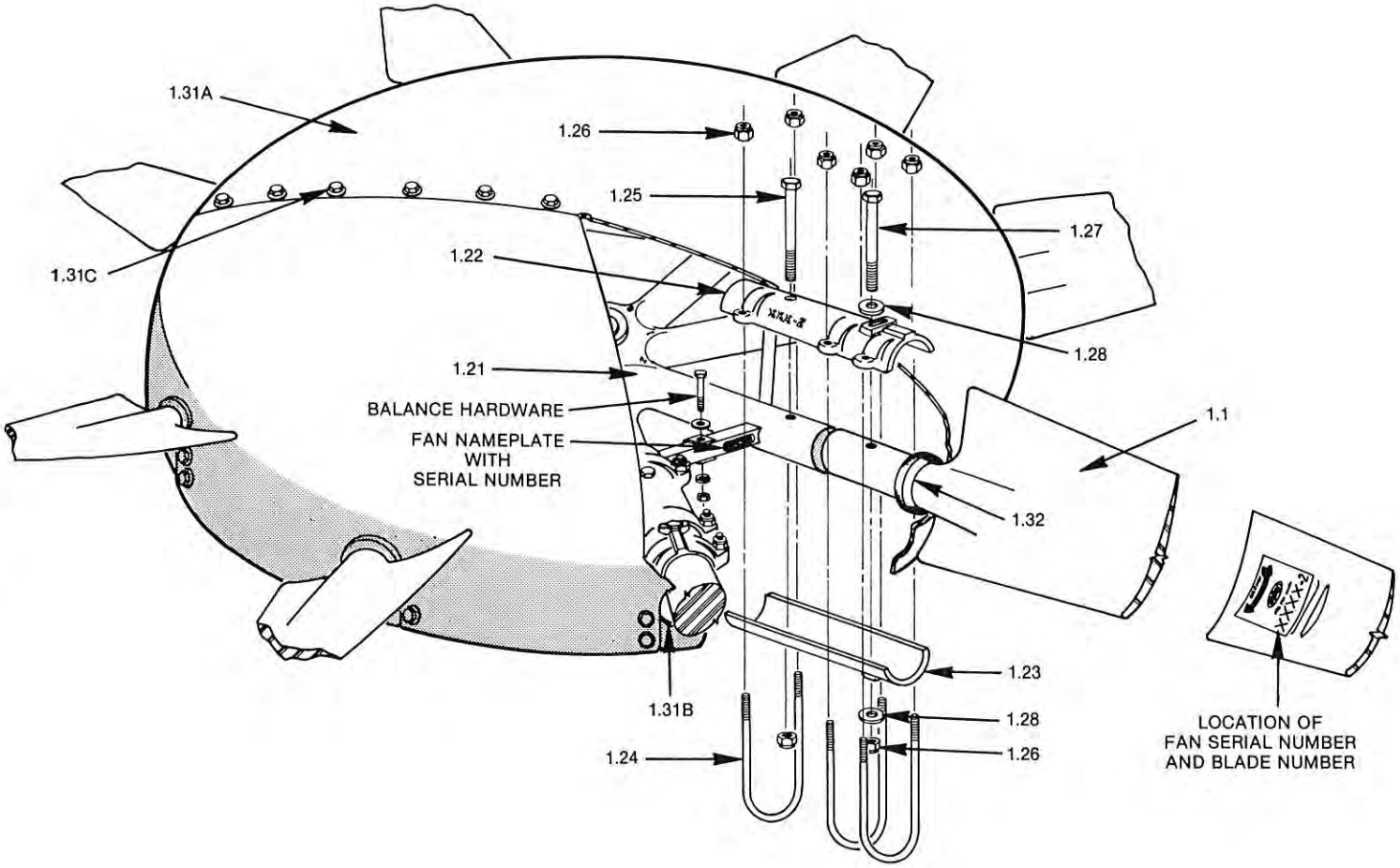
When writing the Marley sales office or representative for repair or replacement parts, please refer to the tower order number and fan serial number.

The Marley Cooling Tower Company
5800 Foxridge Drive
Mission, KS 66202
913 362-1818

PARTS MANUAL SHEET

TYPE HP-4 GLASS REINFORCED POLYESTER BLADE FANS

289" Through 336" Diameter 8 Blade Fans



1.0 COMPLETE FAN ASSEMBLY (Factory Balanced)
- **1.1 FAN BLADE**
- **1.2 FAN HUB ASSEMBLY**
  - 1.21 Fan Hub
  - 1.22 Top Blade Clamp
  - 1.23 Bottom Blade Clamp
  - 1.24 U-Bolt
  - 1.25 Thru Bolt, Inboard
  - 1.26 Self Locking Nut
  - 1.27 Thru Bolt, Outboard
  - 1.28 Washer

1.3 HUB COVER & ATTACHING HARDWARE
- 1.31A Cover Segment
- 1.31B Seal Closure
- 1.31C Bolt, Washers and Self Locking Nut
- 1.32 Grommet

Refer to Fan Service Manual before ordering parts. Your order should include the following information:

1. Fan serial number (from nameplate.)
2. Item number, description and quantity of parts required.
3. If blades are ordered, include original blade numbers.
4. Original Marley order number or tower serial number.

CONTACT YOUR MARLEY SALES OFFICE OR REPRESENTATIVE FOR ASSISTANCE ON ORDER PLACEMENT

Service Manual
Installation, Balancing and Maintenance

SERIES "R" DRIVE SHAFT

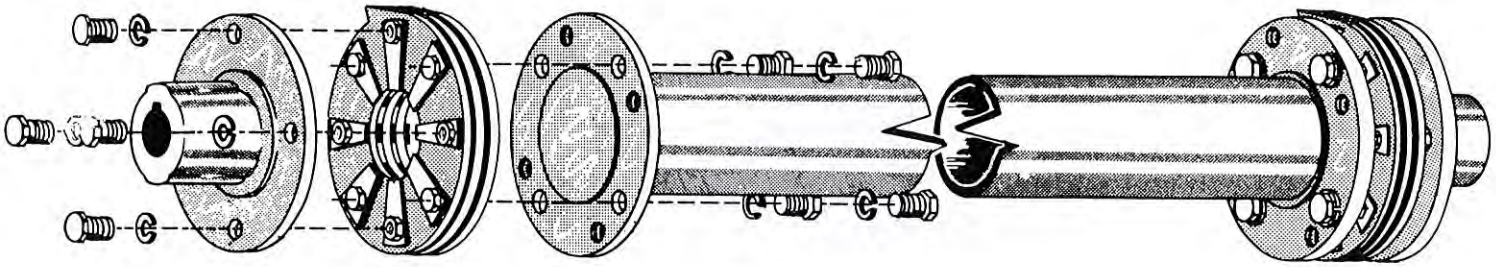


Fig. 1

GENERAL

Marley standard Series "R" drive shafts are furnished with two or three flex-disc couplings. These drive shafts are balanced dynamically and match marked after assembly at the factory. See Figure 2. Do not change position or relation of match marked components during installation.

Replacement parts are available as listed in the Marley parts manual sheet. These drive shafts must be rebalanced whenever parts are replaced.

The drive shaft may be rebalanced on the tower. See instructions on "BALANCING". If field balancing is not practical, the drive shaft can be returned to Marley's plant at Olathe, Kansas for selection of replacement parts and factory rebalance. Obtain "Customer Return Material" tag from Marley sales office or representative to affix to the drive shaft for return.

INSTALLATION

Before installing drive shaft, be sure that motor and Geareducer are on level bases and that their shafts are in reasonable alignment. The Geareducer should be securely bolted to its mounting.

Note match numbers on the drive shaft and remove the yokes. Coat the motor shaft and Geareducer shaft with "Thred-Gard" (Crane Packing Co.) or similar lubricant. Place the key half way in motor and Geareducer shafts, then install yokes. The yokes and keys should be a tight fit on the shafts. Use a wood block when tapping yokes to prevent damage. Tighten each yoke set screw against key.

When bolting the tube and flange (T&F) and coupling assembly to the yokes, make sure the assembly is set between the yoke faces for correct rotation as indicated by the direction arrows on the flex-discs. Match numbers on the drive shaft components, and bolt the T&F and coupling assembly to Geareducer yoke while supporting motor end of T&F and coupling assembly. Slide motor so that motor yoke can be bolted to T&F and coupling assembly without pushing or pulling on motor shaft. Match numbers and bolt the motor yoke to the T&F and coupling assembly.

ALIGNMENT

Check alignment of motor shaft, drive shaft and Geareducer shaft by measuring between the tube and yoke flanges. The final adjustment must be such that the distance between adjacent points on the two flanges does not vary more than 0.005 inch, total indicator reading, as the points make one complete revolution. The best way of measuring this is with a dial indicator. See Marley manual SM-R1-DI for use of a dial indicator in measuring drive shaft alignment. An "Alignment Indicator Kit", part number 72-3968-2 can be purchased from Marley.

A preliminary check on alignment can be made by measuring between the flanges at four points (top, bottom and two sides).

When drive shaft has been properly aligned, tighten all mounting bolts and recheck alignment.

BALANCING

Rebalance drive shafts whenever parts are replaced. Drive shafts may be rebalanced on the tower* by removing the fan on that cell. Use a portable vibration indicator similar to the unit shown in Figure 3 to determine amplitude of vibration in mils. Take readings, with the dial in a horizontal position, on the top of the motor and Geareducer unit being tested, for each of the following conditions:

1. With all equipment running except unit being tested.
2. With all equipment running including motor and Geareducer (less fan) of unit being tested.

**CAUTION: When balancing drive shaft on the tower, do not exceed 30 sec./hour total motor starting time as motor may become overheated.*

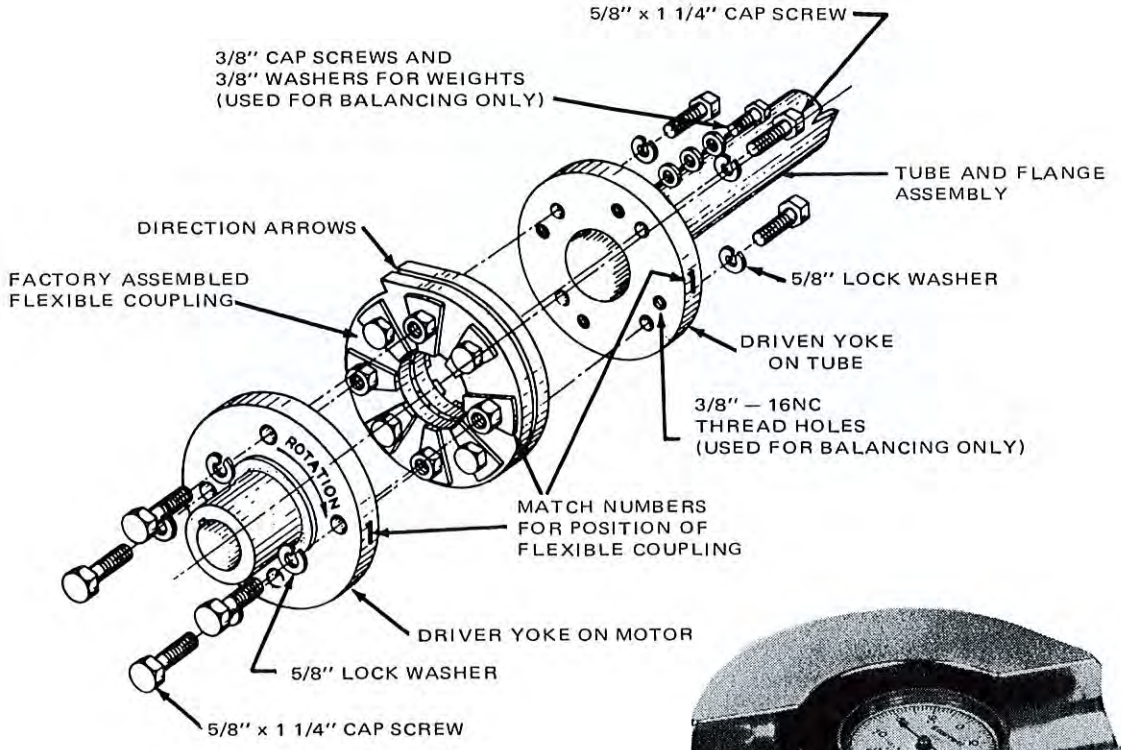


Fig. 2

3. With no equipment running except motor and Geareducer (less fan) of unit being tested.

This gives (1) the basic tower vibration, (2) the total tower vibration, and (3) the vibration for the unit under test.

Readings taken in Step 1 plus Step 3 should nearly equal those taken in Step 2. Vibrations indicated in Step 1 cannot be corrected by adjustments within the cell unit under test. The vibration indicated by the third set of readings must be corrected by balancing the drive shaft under test. It is possible to bring these readings down to .002 except in cases of very long drive shafts, but in no case should these readings be permitted to exceed .005 inch.

Readings on the vibration indicator may be generally brought down below 0.005" T.I.R. by the following method:

Add (or remove) washer weight or weights on one of the 3/8" balancing cap screws in drive shaft tube flange at the motor end (see Figure 2). If improvement is made, continue to add (or remove) more weights at the same point.

NOTE: Adding weights at one point has the same effect as removing similar weights direct-opposite (180°) and vice-versa. This can be used to keep the total weights to a minimum.) If this increases the vibration, restore original condition and repeat same operation on a bolt 90° from the starting point.

After the motor end is adjusted, repeat same operation on the Geareducer end.

If a satisfactory balance cannot be obtained by this method, turn the drive shaft tube and flange assembly end for end and repeat the balancing operation. Vibration indicator readings should be taken on the motor when the drive shaft is disconnected, to determine motor roughness.

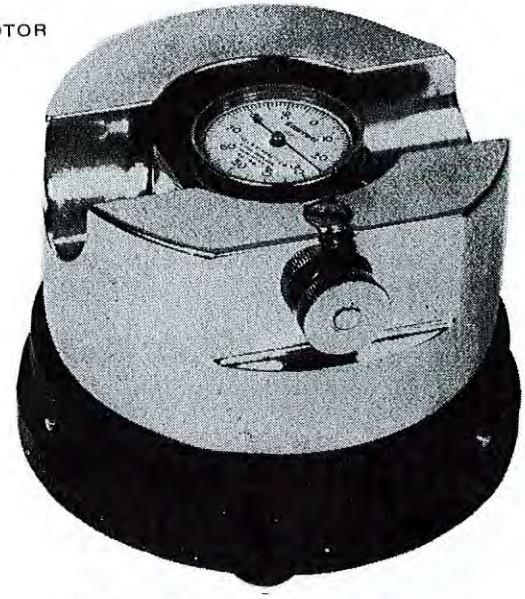


Fig. 3 Dial Type Vibration Indicator

MAINTENANCE

Marley Series "R" drive shafts do not require lubrication.

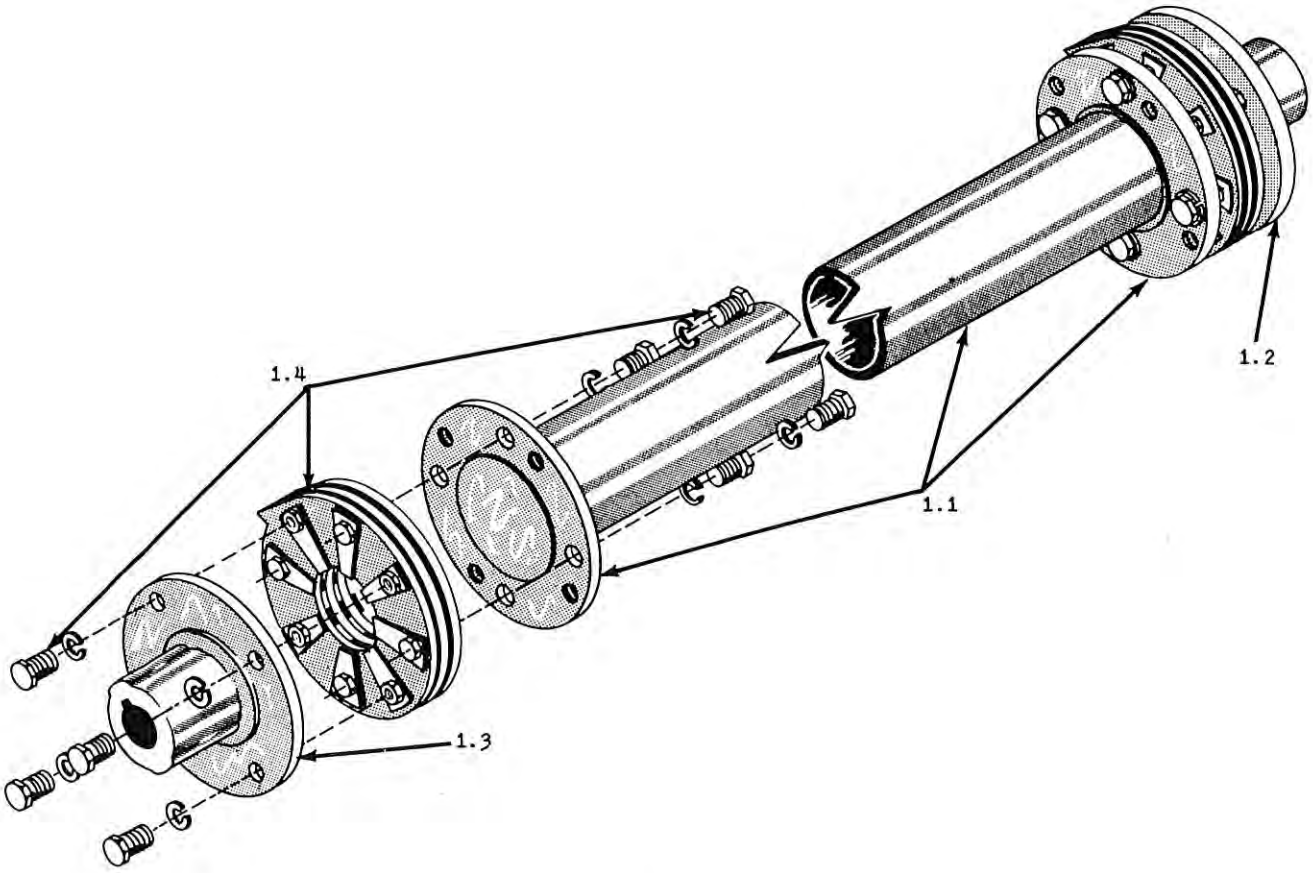
Inspection of the complete drive shaft should be made at least every six (6) months. Look for corrosion, checking or cracking of flex-discs, looseness of cap screws and misalignment of any parts in the flexible couplings.

Accurate drive shaft alignment is required to insure maximum service life. Check alignment as outlined on page 1 under "Alignment". Repair or replace drive shaft parts as necessary.

PARTS MANUAL SHEET - THE MARLEY COMPANY

SERIES "R" 3-DISC TYPE

DRIVE SHAFT ASSEMBLY



REPLACEMENT PARTS

1.0 **COMPLETE DRIVE SHAFT ASSEMBLY,** balanced and ready for installation.

1.1 **TUBE AND FLANGE ASSEMBLY.**

1.2 **GEAREDUCER YOKE** with set screw.

1.3 **MOTOR YOKE** with set screw.

1.4 **FLEXIBLE COUPLING ASSEMBLY,** complete for installation with flexible discs, washers, nuts and cap screws.

NOTE: COMPLETE DRIVE SHAFT ASSEMBLIES ARE FACTORY BALANCED. WHEN REPAIR PARTS ARE INSTALLED, SHAFT MUST BE REBALANCED. (See Service Manual on Marley Series "R" Drive Shafts.)

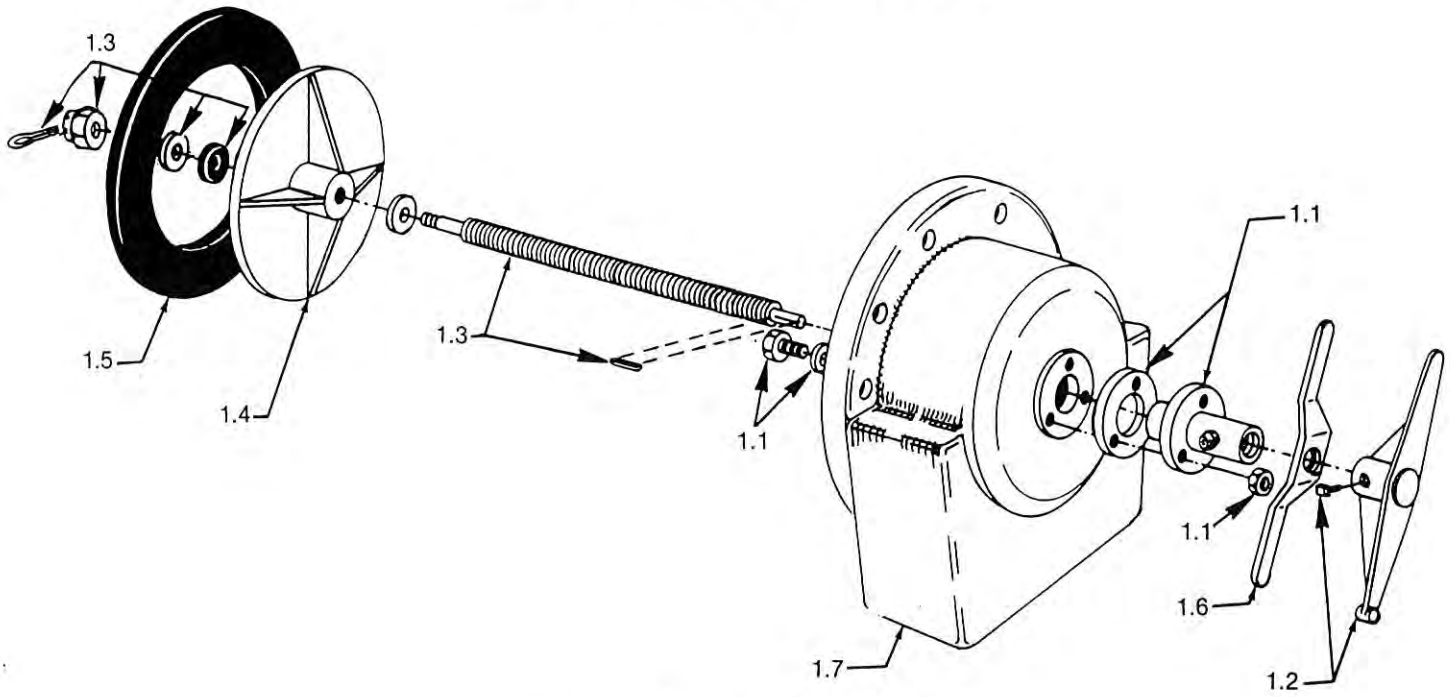
TOWER SERIAL NO.

Note Serial Number of Tower in Correspondence

MARLEY

PARTS MANUAL SHEET

HORIZONTAL FLOW CONTROL VALVES
10", 12", 14", 16", 18" AND 20" DIAMETERS
MAXIMUM PRESSURE 25 P.S.I. (1.75 BAR)



REPLACEMENT PARTS

ITEM 1.0 COMPLETE VALVE ASSEMBLY, ready for installation.
ITEM 1.1 VALVE STEM GUIDE WITH GREASE FITTING, GASKET, AND ATTACHING HARDWARE.
ITEM 1.2 OPERATING HANDLE WITH SET SCREW
ITEM 1.3 VALVE STEM WITH KEY, WASHERS, RESILIENT WASHER, CASTLE NUT AND COTTER PIN.
ITEM 1.4 VALVE DISC
ITEM 1.5 VALVE BODY GASKET. 10" valve illustrated with ring gasket. 12" thru 20" valves use full face gaskets.
ITEM 1.6 LOCKING BAR
ITEM 1.7 VALVE BODY

ASSEMBLY SEQUENCE

1. ATTACH VALVE STEM GUIDE AND GASKET TO VALVE BODY.
2. PLACE VALVE DISC AND WASHERS ON VALVE STEM. INSTALL CASTLE NUT AND TIGHTEN TO COMPRESS RESILIENT WASHER TO 1/8" to 3/16" THICK. INSTALL COTTER PIN.
3. INSTALL VALVE STEM AND DISC SUB-ASSEMBLY THROUGH VALVE STEM GUIDE. CENTER VALVE DISC IN VALVE INLET OPENING BY DIFFERENTIAL TIGHTENING OF THE THREE VALVE STEM GUIDE MACHINE BOLTS.
4. INSTALL LOCKING BAR ON VALVE STEM.
5. INSERT KEY IN VALVE STEM KEYWAY AND INSTALL OPERATING HANDLE. TIGHTEN SET SCREW AGAINST KEY.
6. GREASE VALVE STEM THREADS AT GREASE FITTING USING RUST INHIBITING LITHIUM BASE GREASE OF NLGI NO. 2 CONSISTENCY. COAT EXPOSED VALVE STEM THREADS WITH GREASE.
7. AFTER ADJUSTING THE FLOW, SET THE LOCKING BAR IN THE LOCKED POSITION TO STABILIZE THE STEM AND DISC.

When ordering parts always provide original Marley order number and tower serial number. Contact the Marley sales office or representative in your area for assistance.

INFORMATION ONLY

MARLEY

cooling tower

OPERATING MANUAL

PREPARED FOR CITY OF HOUMA

Houma, Louisiana

unit 16

GPM 34,000 HW 104 CW 87 WB 80

Tower Model No.	6515-4-03
Tower Serial No.	6515-12-172-74
Customer Order No.	-----
Marley Order No.	12-172-74
Geareducer & Ratio	Series 34.3T, 13.00/1 Ratio
Fan Diameter	336", HP-4-8
Trial Fan Pitch	15 1/2°
Fan R.P.M.	135
Contract Brake Horse Power	125
Driveshaft	Type 301, Class III
Flow Control Valve Size	20"
Pipe Material	RPM
Vibration Switch	M-1

Please refer to Marley Order Number and Tower Serial Number in correspondence concerning this tower.

THE MARLEY COOLING TOWER COMPANY

5800 Foxridge Drive — Mission, Kansas 66202

SUPPLEMENT
TO
Manual OM-600B

Class 600 Operation & Maintenance Instructions

Additional instructions for towers furnished with fiberglass hot water distribution piping:

STARTING PROCEDURE

FILLING THE WATER SYSTEM

Completely open all hot water flow control valves; then prime and start the circulating water pumps. Increase the flow of circulating water gradually to full flow to avoid surges or water hammer which could damage the fiberglass piping. Increase of flow can be controlled either by regulating the increase of pump speed or by regulating the speed of opening pump discharge valves. We recommend posting instructions in the control room or at the pump discharge valves to remind operator of proper procedure to gradually increase circulating water flow at startup.

With full flow over tower, adjust flow control valves to equalize the hot water flow to each distribution basin.

MARLEY

MANUAL

Class 600 Industrial
CROSS-FLOW COOLING TOWERS

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Operation and Maintenance Instructions

JANUARY, 1976

OM-600D

5800 Foxridge Drive – P.O. Box 2912 – Mission, Kansas 66201

PRINTED IN U.S.A.

TABLE OF CONTENTS

Class 600 Industrial
CROSS-FLOW COOLING TOWERS

Operation and Maintenance Instructions

GENERAL

These instructions will assist in obtaining efficient, long life from Marley cooling equipment. Direct questions concerning tower operation and maintenance to your Marley sales office or representative. Always include your tower serial number when writing for information or ordering parts. Look for this number on the nameplate near the access door.

PRE-STARTING PROCEDURE

CLEANING. Remove any dirt and trash which has accumulated in the hot water distribution basins. Make sure there are no clogged nozzles. Remove any sediment from the cold water basin, sump and screens. Use a water hose to flush cold water basins.

OPERATE WATER SYSTEM. Completely open all hot water flow control valves. Start the circulating water pumps. Increase the flow of circulating water gradually to design water rate to avoid surges or water hammer which could damage the distribution piping. Circulate water over the tower continuously for several days before starting the mechanical equipment and putting the tower into continuous operation.

INSPECTION. It is imperative that all operating assemblies be inspected before they are placed in operation. Following is a list of components to be checked before starting the tower:

1. Check drive shaft alignment. Realign if necessary. See Marley Drive Shaft Service Manual.
2. Check tightness of bolts that attach steel mechanical equipment support to the tower framing. Check tightness of bolts in fan cylinder joints and fan cylinder anchorage. Do not pull washers into the wood.
3. Check tightness of bolts at diagonals and columns, and at girts and columns in the area between fan and cold water basin.
4. Check tightness of the following bolted joints in the fan and drive assemblies:
   (a) Fan hub clamp bolts (see Marley Fan Service Manual for correct torque setting).
   (b) Fan hub cover bolts.
   (c) Geareducer and motor mounting bolts.
   (d) Drive shaft coupling and guard bolts.
5. Check Geareducer oil for sludge or water by draining off and testing a sample, as outlined in the Geareducer Service Manual. *Check Geareducer oil level at "oil level" mark on the side of the case. Add oil as required. The oil level placard must be adjusted so its "full" mark is at the same elevation as the "full" mark on the side of the Geareducer case. Check oil lines to be sure there are no leaks and all joints are tight.* See Geareducer Service manual for oil filling procedure and list of recommended lubricants.
6. Rotate fan by hand to be sure of free rotation and ample tip clearance. See Fan Service Manual.
7. Check motor insulation with a "Megger". See Maintenance section of Marley Service Manual on Electric Motors.
8. *Lubricate the motor according to motor manufacturer's instructions.*
9. Test run each fan separately for a short time. Check for excessive vibration or unusual noise. If either is present, see Tower Trouble Tips on pages 8 and 9 of this manual. Fan must rotate clockwise when viewed from above. Recheck Geareducer oil level.
10. Check functioning of make-up water supply.
11. Make sure the blowdown or bleed-off will carry the proper amount of water.

STARTING PROCEDURE

FILLING THE WATER SYSTEM. Fill the cold water basin and circulating water system until the operating water level is reached. See Operation section, page 4.

Completely open all hot water flow control valves; then prime and start the circulating water pumps. Increase the flow of circulating water gradually to design water rate to avoid surges or water hammer which could damage the distribution piping. Adjust valves to equalize the hot water depth in the distribution basins. Lock valves in desired open position with valve locking bar.

On towers equipped with redwood stave distribution piping, some seepage at edge joints may occur during pre-start up and in the initial stages of operation. After the first two weeks of continuous operation, check tightness of nuts securing GRP pipe bands on the redwood stave pipe. Nuts should be snug. Do not over-tighten.

Clean the sump screens several times during the first weeks of operation. After this, clean sump screens as required.

STARTING THE FAN. Start the fan. After 30 minutes operating time to permit Geareducer oil to come up to

operating temperature, check motor load with watt meter, or take operating volt and ampere readings and calculate motor HP. Refer to Marley Fan Service Manual for instructions. Pitch fans to pull correct contract horsepower when circulating design water rate at design hot water temperature.

OPERATION

TOWER PERFORMANCE. Keep the tower clean and the water distribution uniform to obtain continued maximum cooling capacity. Do not allow excessive deposits of scale or algae to build up on the filling or eliminators. Keep the metering orifices free of debris to assure correct distribution and cooling of water.

The capacity of a tower to cool water to a given cold water temperature varies with the wet-bulb temperature* and the heat load on the tower. As the wet-bulb temperature drops, the cold water temperature also drops. However, the cold water temperature does not drop as much as the wet-bulb temperature.

A tower does not control the heat load. The quantity of water circulated determines the cooling range** for a given heat load. The hot and cold water temperature increases with higher heat loads.

COLD WATER COLLECTING BASIN. The normal water depth in a wood basin is 5 to 8 inches, while in a concrete basin, the normal water level is 9 to 15 inches below the curb. Adjust the make-up water supply to maintain this water level. Low operating depths of the water require air baffles under the fill to prevent air bypass. Maintain sufficient water depth to prevent cavitation.

HOT WATER DISTRIBUTION SYSTEM. Keep metering orifices clean and in place in distribution basins. Adjust water flow to give the same depth in the distribution basins of all cells. Design water depth varies from 3" to 6" depending upon design circulating water rate. If a major change in the quantity of water to be circulated over the tower is to be made, replace the removable metering orifices with ones of the new correct orifice size to provide adequate water break-up and maintain the proper water level.

If an Amertap condenser tube cleaning system is part of plant equipment, care should be taken during operation to back-wash the strainer section only after the sponge rubber cleaning balls are removed from the system by trapping them in the collector. If the balls are allowed to enter the cooling tower supply piping, they can clog the plastic metering orifices. Clogged orifices will cause unequal water distribution over the fill which will affect thermal performance. Extensive clogging can lead to overflowing the distribution basins and possible ice damage to towers installed in freezing climates. The basins should be frequently checked for orifice clogging until such time as the operational sequence of the Amertap system assures that no balls enter the cooling tower piping.

FAN DRIVE. If a two-speed motor is used, *allow a time delay of a minimum of 20 seconds after de-energizing the high speed winding and before energizing the low speed winding.* Tremendous stresses are placed on driven machinery and motor unless the motor is allowed to slow to low speed rpm or less before the low speed winding is energized. *When changing fan direction of rotation, allow a minimum of two minutes time delay before energizing the fan motor.*

WINTER OPERATION. During periods of low temperature operation, 35° to 40°F or below, ice will form on the relatively dry parts of the tower that are in contact with the incoming air. Primarily, this includes the louvers and adjacent structural framing.

Ice forming characteristics on any given tower will vary, depending on velocity and direction of wind, circulating water rate and heat load. Excessive ice formation may be controlled by regulating air and water flow through the tower by one or more of the following procedures:

1. Shut the fan down. This reduces the cooling rate to a minimum and increases the quantity of warm water on the louvers to a maximum. Except for extreme cold conditions or extended freezing conditions, this procedure will normally control ice formation. For automatic operation, a timer switch can be provided to shut the fan down for a few minutes each hour.
2. If the tower has two-speed motors, operate the fan at half speed forward. This reduces the cooling rate (heat transfer) and increases the quantity of warm water on the louvers.
3. Under extended extreme cold conditions, it may be necessary to operate the fan in reverse. This forces warm air out through the louvers, melting any accumulated ice. Reversal may be at either full or half speed, however, full speed is recommended if adequate heat load is available. Reverse operation of the fan should only be used to control ice, not prevent it. *Reverse fan operation should not exceed 15 to 20 minutes.* Usually much less time than this is required to melt accumulated ice.
4. With no heat load on the circulating water, icing can not be controlled effectively by air control during freezing weather. Towers must not be operated with reduced water rate and/or no heat load during freezing weather. If a by-pass directly into the cold water basin is used, all water must be by-passed. Design of a by-pass arrangement must include consideration of water impact effect on tower components.

CAUTION: Severely Cold Weather – Below 20°F. Ambient Dry Bulb – Reverse operation of fans for prolonged periods during sub-freezing weather can cause severe damage to fans and fan cylinders. Ice can accumulate inside fan cylinders at fan blade plane of rotation and fan blade tips will eventually strike this ring of ice, damaging the fan blades or cylinder. Ice can also accumulate on fan blades and be thrown off, damaging fan cylinder or blades. Reverse oper-

*Wet-bulb temperature – the temperature indicated by the wet-bulb thermometer of a sling or mechanically aspirated psychrometer.

**Cooling range – the temperature difference between the hot water coming into the cooling tower and the cold water leaving the tower.

ation of fans with adjacent fans not operating increases probability of icing. The low discharge velocity of moist air from fan cylinders in which fans are not in operation can result in moisture ladened air being pulled into the adjacent cylinder is which the fan is operating in reverse, increasing this ice build-up. Therefore, fans each side of the one operating in reverse must be operated in forward rotation at full or half speed, or all fans must be operated in reverse. Allow a minimum of 10 minute delay between reverse operation and forward operation during sub-freezing weather to permit ice to dissipate from fan blades and fan cylinders.

See "Fan Drive" for fan speed change and reversing precautions.

UNIT MAINTENANCE

Well maintained equipment gives the best operating results and the least maintenance cost. Marley recommends setting up a regular inspection schedule to insure effective operation of the cooling tower. Use the schedule in Table I to obtain continuously good performance with least tower maintenance. See Cooling Tower Inspection Check List in this manual. Keep a continuous lubrication and maintenance record for each cooling tower. For a supply of Check List forms, contact your Marley sales office or representative.

HOT WATER DISTRIBUTION BASINS. Metering orifices in the floor of the hot water basins may be cleaned without shutting down any part of the tower. Remove dirt, algae, leaves, etc., which might get in these basins or orifices. The metering orifices must be kept in place to assure proper water distribution.

Completely open and close flow control valves at least semi-annually to remove any scale on the threads. Grease the stainless steel stem to prevent scale forming. Lubricate the valves at least semi-annually with a lithium base NLGI No. 2 consistency grease. More frequent relubrication of valves and valve stems may be dictated by circulating water conditions.

TABLE I

INSPECTION & MAINTENANCE SCHEDULE

General Recommendations

(More frequent inspection and maintenance may be desirable)

	FAN	MOTOR	DRIVESHAFT	GEAREDUCER	ELIMINATOR	FILL	COLD WATER BASIN	HOT WATER BASIN	FLOAT VALVE	SUCTION SCREEN	CONTROL VALVES	STRUCTURAL MEMBERS	CASING	FAN CYLINDER
1. Inspect for clogging								W		W				
2. Check for unusual noise or vibration	D	D	D	D										
3. Inspect keys, keyways and set screws	S	S	S	S										
4. Make sure vents are open				S										
5. Lubricate (grease)		R									S			
6. Check oil seals				M										
7. Check oil level				W										
8. Check oil for water & sludge				M										
9. Change oil, at least				S										
10. Check fan blade tip clearance	S													
11. Check water level							D	D						
12. Check for leakage				W			S	S	S					
13. Inspect general condition	S	S	S	S	Y	S	Y	S	Y	S	S	S	Y	S
14. Tighten loose bolts	S	S	S	S								Y	R	S
15. Clean	R	R	R	R	R	R	S	R	R	R	R			
16. Repaint	R	R	R	R										
17. Rebalance	R		R											
18. Completely open and close											S			

D–daily; W–weekly; M–monthly; Q–quarterly; S–semiannually; Y–yearly; R–as required

COLD WATER COLLECTING BASIN. Inspect collecting basin occasionally for leaks and repair if necessary. Minor leaks may appear in redwood basins when starting with a dry basin but these generally disappear after the wood becomes soaked. Keep cold water outlets clean and free of debris. Make-up and circulating water controls must operate freely and maintain the desired water quantity in the system.

TOWER FRAMEWORK. Keep framework bolts tight. Pay particular attention to bolts in the mechanical equipment supports. Do not pull washers into the wood.

DRIVE SHAFT. Check drive shaft alignment and condition of couplings every six months. See the Drive Shaft Service Manual for correcting misalignment, balancing or replacing parts.

ELECTRIC MOTOR. Lubricate and maintain each electric motor in accordance with the manufacturer's instructions. If repair work is necessary, contact the nearest representative of the motor manufacturer. See Warranty Section of Marley Service Manual on Electric Motors.

FAN. Inspect fan blade surfaces every six months. For detailed maintenance information, refer to Marley Fan Service Manual.

GEAREDUCER. Make weekly and monthly oil checks. Inspect internal parts during seasonal oil change. Refer to the Geareducer Service Manual for detailed maintenance instructions.

PAINTING. Periodically clean and, if necessary, recoat all metal parts subject to corrosion.

COOLING TOWER WOOD DETERIORATION. Untreated wood in cooling towers can be damaged by decay anytime after the first year or two of service. If decay is discovered and treated in its early stages, serious wood damage can be prevented. Routine inspections should be made to assure that decay is discovered before it is heavily advanced.

Decay is commonly of two very general types, soft rot and pocket rot. Soft rot is easier to detect because it is almost always on the surface of wood members. It makes the surface soft and weak and in its more advanced stages the decayed wood can be easily removed. This type of rot occurs primarily in the flooded areas of the tower. Pocket rot, as the name implies, occurs in pockets inside of the wood members. For this reason it is more difficult to detect than is soft rot. Pocket rot is most commonly found in the heavier members in the plenum areas of the tower. One of the best methods of inspection for pocket rot is "sounding" with hammer blows. Members which have pocket rot sound "dead" while non-rotted members have a "ring" or "live" sound. Areas which sound "dead" can be probed with an ice pick or other pointed tool to verify the presence of pocket rot.

Marley maintains a laboratory for detailed wood inspections and has personnel on its staff experienced in all aspects of wood deterioration and preservative treatment. In addition, several Marley publications are available which give detailed information on the subject of wood deterioration and treatment. Contact the nearest Marley sales office or representative for more information about wood inspection services and for copies of the publications.

WATER TREATMENT

BLOWDOWN. Blowdown, or bleed-off, is the continuous removal of a portion of the water from the circulating system. Blowdown is used to prevent the dissolved solids from concentrating to the point where they will form scale. The amount of blowdown required depends upon the cooling range (the difference between the hot and cold water temperatures) and the composition of the make-up water (water added to the system to compensate for losses by blowdown, evaporation and drift). The following table shows the amount of blowdown required to maintain different concentrations with various cooling ranges:

Blowdown — % of Circulating Rate

COOLING RANGE °F	CONCENTRATIONS						
	1.5X	2.0X	2.5X	3.0X	4.0X	5.0X	6.0X
5	.78	.38	.25	.18	.11	.08	.06
10	1.58	.78	.51	.38	.25	.18	.14
15	2.38	1.18	.78	.58	.38	.28	.22
20	3.18	1.58	1.05	.78	.51	.38	.30
25	3.98	1.98	1.32	.98	.64	.48	.38

EXAMPLE: 7000 GPM circulating rate, 15° cooling range. To maintain 4 concentrations, the required blowdown is .38% or .0038 times 7000 GPM which is 26.6 GPM.

If tower is operated at 4 concentrations, circulating water will contain four times as much dissolved solid as the makeup water, providing none of the solids form scale or are otherwise removed from the system.

CHEMICAL TREATMENT. In some cases chemical treatment of the circulating water is not required if adequate blowdown is maintained. In most cases, however, chemical treatment is required to prevent scale formation and corrosion. Sulfuric acid or one of the polyphosphates is most generally used to control calcium carbonate scale. Various proprietary materials containing chromates, phosphates or other compounds are available for corrosion control. When water treatment chemicals are required, the services of reliable water treating companies should be obtained.

Slime, a gelatinous organic growth, and algae, a green moss, may grow in the cooling tower or heat exchangers. Their presence can interfere with cooling efficiencies. Proprietary compounds are available from water treating companies for the control of slime and/or algae, however, compounds which contain copper must be used with care. Copper can accelerate corrosion of steel, iron, aluminum and galvanizing and should not be used in systems containing any of those materials. Chlorine and chlorine containing compounds are effective algaecides and slimicides but excess chlorine can damage wood and other organic materials of construction. If used, chlorine should be added as intermittent (or shock) treatment only as frequently as needed to control the slime and algae, and free residual levels should

not exceed one part per million parts water (1 ppm). If compounds such as calcium hypochlorite are used, they should be added carefully since very high levels of chlorine occur at the point of entry into the circulating water system.

FOAMING. Heavy foaming sometimes occurs when a new tower is put into operation. This type of foaming generally subsides after a relatively short period of operation. Persistent foaming can be caused by the concentrations of certain combinations of dissolved solids or by contamination of the circulating water with foam-causing compounds. This type of foaming can sometimes be minimized by increasing the blowdown, but in some cases foam depressant chemicals must be added to the system. Foam depressants are available from a number of chemical companies.

WATER DISCOLORATION. Woods contain some water soluble substances and these commonly discolor the circulating water on a new tower. This discoloration is not harmful to any of the components in the system and can be ignored. However, a combination of foaming and discolored water can result in staining of adjacent structures if foam is picked up by air being pulled through the tower and discharged out the fan cylinders. Avoid operation of fans until the foaming is controlled.

SPARE PARTS

Marley maintains a stock of replacement parts for mechanical equipment. Shipment of these parts is normally made within ten days after an order is received. If emergency service is necessary, contact the local Marley sales office or representative for assistance.

To prevent prolonged shutdown periods in case of damage to the mechanical equipment, it is suggested that the following parts be carried in the owner's stock:

1. One fan assembly.
2. One Geareducer assembly.
3. One drive shaft assembly.

Be sure to furnish the tower serial number when ordering any parts.

SEASONAL SHUTDOWN INSTRUCTIONS

BASIN AND FRAME

Drain the tower basins and all exposed piping. Leave the cold water basin drain open. Water may be left in wood cold water basin if tower is located in a non-freezing area.

During shutdown, clean the tower and make any necessary repairs. Apply protective coating as required to all metal parts. Particular attention should be given to mechanical equipment supports, drive shaft and drive shaft guards. Inspect visually for wood deterioration and test members for soft spots.

Protect wood towers against fire. If tower is wetted for fire protection, wet it down continuously; alternate wetting and drying is destructive to wood.

MECHANICAL EQUIPMENT

Flow Control Valve

Grease valve threads at zerk fitting using rust inhibiting lithium base grease of NLGI No. 2 consistency and then open valve. Coat exposed valve stem with grease.

Geareducers

1. At shutdown, operate Geareducer until oil is warm. Drain and refill.
2. Each month, drain water condensate from the lowest point of the Geareducer and its oil system. Check oil level and add oil if necessary. Operate to re-coat all interior surfaces with oil.
3. At start-up, drain water condensate and check oil level. Add oil if necessary.

Refer to Geareducer service manual for maintenance and lubrication instructions.

Electric Motors

Do not start motor without determining that there will be no interference with free rotation of the fan drive.

Refer to motor manufacturer's recommendations for lubrication and maintenance instructions.

If shutdown period is longer than seasonal, contact your Marley sales office or representative for additional information.

TOWER TROUBLE TIPS

TROUBLE	CAUSE	REMEDY
Motor Will Not Start	Power not available at motor terminals	1. Check power at starter. Correct any bad connections between the control apparatus and the motor. 2. Check starter contacts and control circuit. Reset overloads, close contacts, reset tripped switches or replace failed control switches. 3. If power is not on all leads at starter make sure overload and short circuit devices are in proper condition.
	Wrong connections	Check motor and control connections against wiring diagrams.
	Low voltage	Check nameplate voltage against power supply. Check voltage at motor terminals.
	Open circuit in motor winding	Check stator windings for open circuits.
	Motor or fan drive stuck	Disconnect motor from load and check motor and Geareducer for cause of problem.
	Rotor defective	Look for broken bars or rings.
Unusual Motor Noise	Motor running single-phase	Stop motor and attempt to start it. Motor will not start if single-phased. Check wiring, controls and motor.
	Motor leads connected incorrectly	Check motor connections against wiring diagram on motor.
	Ball bearings	Check lubrication. Replace bad bearings.
	Electrical unbalance	Check voltages and currents of all three lines. Correct if required.
	Air gap not uniform	Check and correct bracket fits or bearing.
	Rotor unbalance	Rebalance.
	Cooling fan hitting guard	Reinstall or replace fan.
Motor Runs Hot	Wrong voltage or unbalanced voltage	Check voltage and current of all three lines against nameplate values.
	Overload	Check fan blade pitch. See Fan Service Manual. Check for drag in fan drive train as from damaged bearings.
	Wrong motor rpm	Check nameplate against power supply. Check rpm of motor and gear ratio.
	Bearings overgreased	Remove grease reliefs. Run motor up to speed to purge excessive grease.
	Rotor rubs stator bore	If not poor machining, replace worn bearing.
	Wrong lubricant in bearings	Change to proper lubricant. See motor manufacturer's instructions.
	One phase open	Stop motor and attempt to start it. Motor will not start if single-phased. Check wiring, controls and motor.
	Poor ventilation	Clean motor and check ventilation openings. Allow ample ventilation around motor.
	Winding fault	Check with Ohmmeter.

TOWER TROUBLE TIPS

TROUBLE	CAUSE	REMEDY
Motor Runs Hot (continued)	Bent motor shaft	Straighten or replace shaft.
	Insufficient grease	Remove plugs and regrease bearings.
	Deterioration of or foreign material in grease	Flush bearings and relubricate.
	Bearings damaged	Replace bearings.
	Incorrect fan blade pitch	See Fan Service Manual for blade pitching instructions.
Motor Does Not Come Up To Speed	Voltage too low at motor terminals because of line drop	Check transformer and setting of taps. Use higher voltage on transformer terminals or reduce loads. Increase wire size or reduce inertia.
	Broken rotor bars	Look for cracks near the rings. A new rotor may be required. Have motor service man check motor.
Wrong Rotation (Motor)	Wrong sequence of phases	Change any two of the three motor leads.
Geareducer Noise	Geareducer bearings	If new, see if noise disappears after one week of operation. Drain, flush and refill Geareducer. See Geareducer Service Manual. If still noisy, replace.
	Gears	Correct tooth engagement. Replace badly worn gears. Replace gears with imperfect tooth spacing or form.
Unusual Fan Drive Vibration	Loose bolts and cap screws	Tighten all bolts and cap screws on all mechanical equipment and supports.
	Unbalanced drive shaft or worn couplings	Make sure motor and Geareducer shafts are in proper alignment and "match marks" properly matched. Repair or replace worn couplings. Rebalance drive shaft by adding or removing weights from balancing cap screws. See Drive Shaft Service Manual.
	Fan	Be sure blades are properly positioned in correct sockets. Check match numbers. Make certain all blades are as far from center of fan as safety devices permit. All blades must be pitched the same. See Fan Service Manual. Clean off deposit build-up on blades.
	Worn Geareducer bearings	Check fan and pinion shaft endplay. Replace bearings as necessary.
	Unbalanced motor	Disconnect load and operate motor. If motor still vibrates, rebalance rotor.
	Bent Geareducer shaft	Check fan and pinion shafts with dial indicator. Replace if necessary.
Fan Noise	Loose fan hub cover	Tighten hub cover fasteners.
	Blade rubbing inside of fan cylinder	Adjust cylinder to provide blade tip clearance.
	Loose bolts in blade clamps	Check and tighten if necessary.

MARLEY

COOLING TOWER INSPECTION CHECK LIST

ORIGINAL

Route to:

Owner _____ Date Inspected _____

Plant _____ Inspected By _____

Location _____ Tower Manufacturer _____

Owner Designation _____ Installed _____ 19 _____

Water Treatment Used _____ Model No. _____

Design Conditions _____ GPM _____ HW _____ CW _____ WB

Condition: 1 - Good; 2 - Repair; 3 - Replace	1	2	3
EXTERIOR STRUCTURE:			
1. Endwall Casing & Access Doors			
2. Louvers ( )			
3. Drain Boards			
4. Stairway			
5. Fan Deck			
6. Fan Deck Supports			
7. Handrails			
8. Ladders & Walkways			
9. Distribution System			
Headers (Type)			
Distribution Basin			
Water Level			
Flow Control Valves (Size)			
Nozzles (Size)			
Water Distribution			
10. Spray System & Spray Nozzles			
11. Fan Cylinders (Type)			
INTERIOR STRUCTURE:			
12. Fill (Type)			
13. Columns			
14. Girts			
15. Diagonals			
16. Partitions & Doors			
17. Eliminators (Type)			
18. Walkway			
19. Cold Water Basin (Type)			
Water Depth			
20. Mech. Equip. Support (Type)			

Condition: 1 - Good; 2 - Repair; 3 - Replace	1	2	3
MECHANICAL EQUIPMENT			
21. Drive Shafts (Type)			
22. Speed Reducer			
Series _____ Ratio _____			
Oil Level			
Oil Seals			
Vent			
Back Lash			
Pinion Shaft Play			
Fan Shaft End Play			
Last Oil Change (Date)			
Oil Used			
23. Fans			
Dia. _____ Type _____			
Hub			
Blades			
Hub Cover			
Tip Clearance			
No Vibration _____ Vibration _____			
Additional Components (If installed on tower)			
Fan Guards			
Oil Gauge & Drain Lines			
Vibration Limit Switches			
Other:			
24. Motor: Mfr.			
Name Plate _____ HP _____ RPM			
Phase _____ Cycle _____ Volts _____			
Amperes _____ Frame _____			

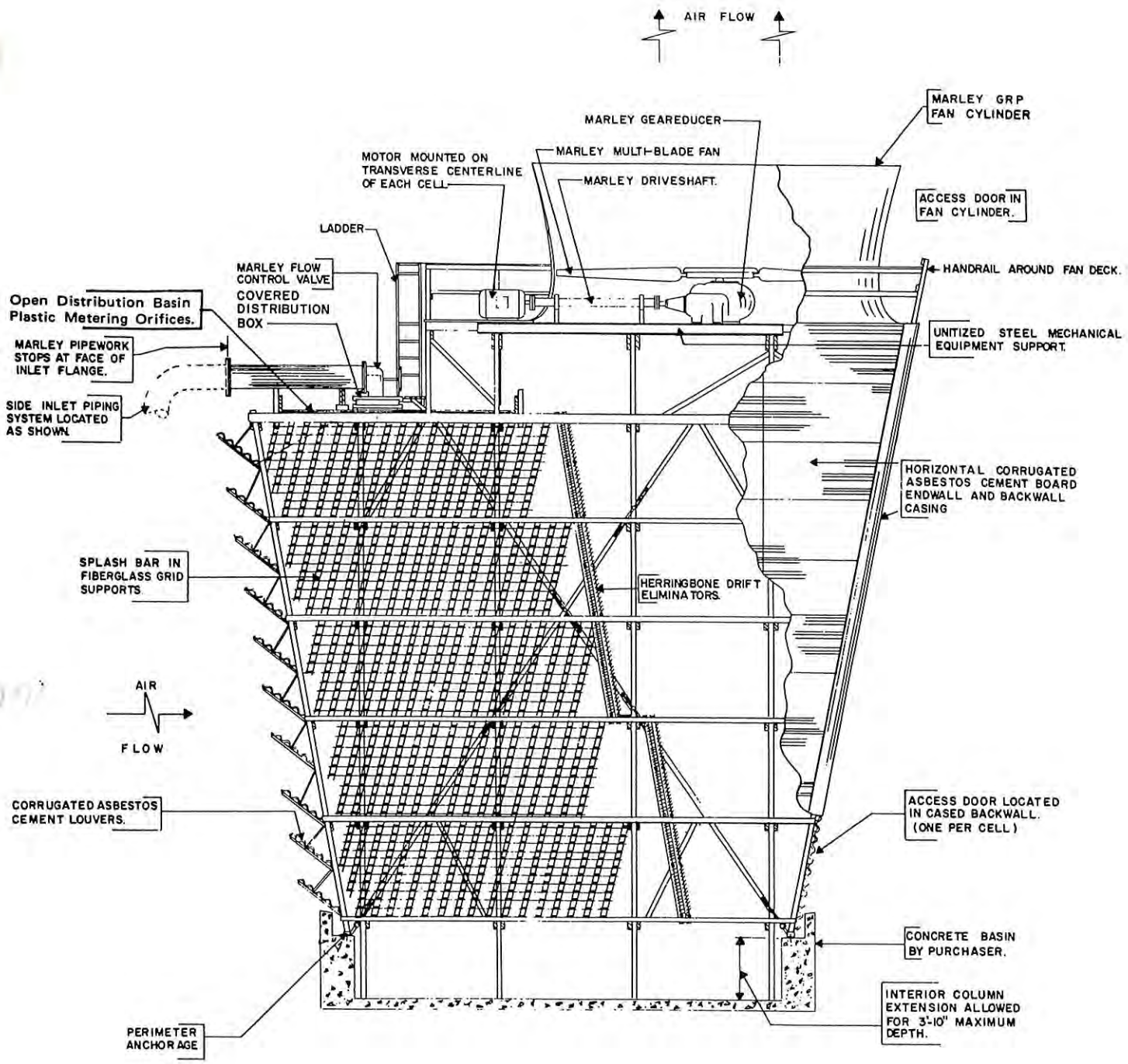
REPLACEMENT PARTS REQUIRED:

QUANTITY	DESCRIPTION	ORDER FROM	DATE REQ'D

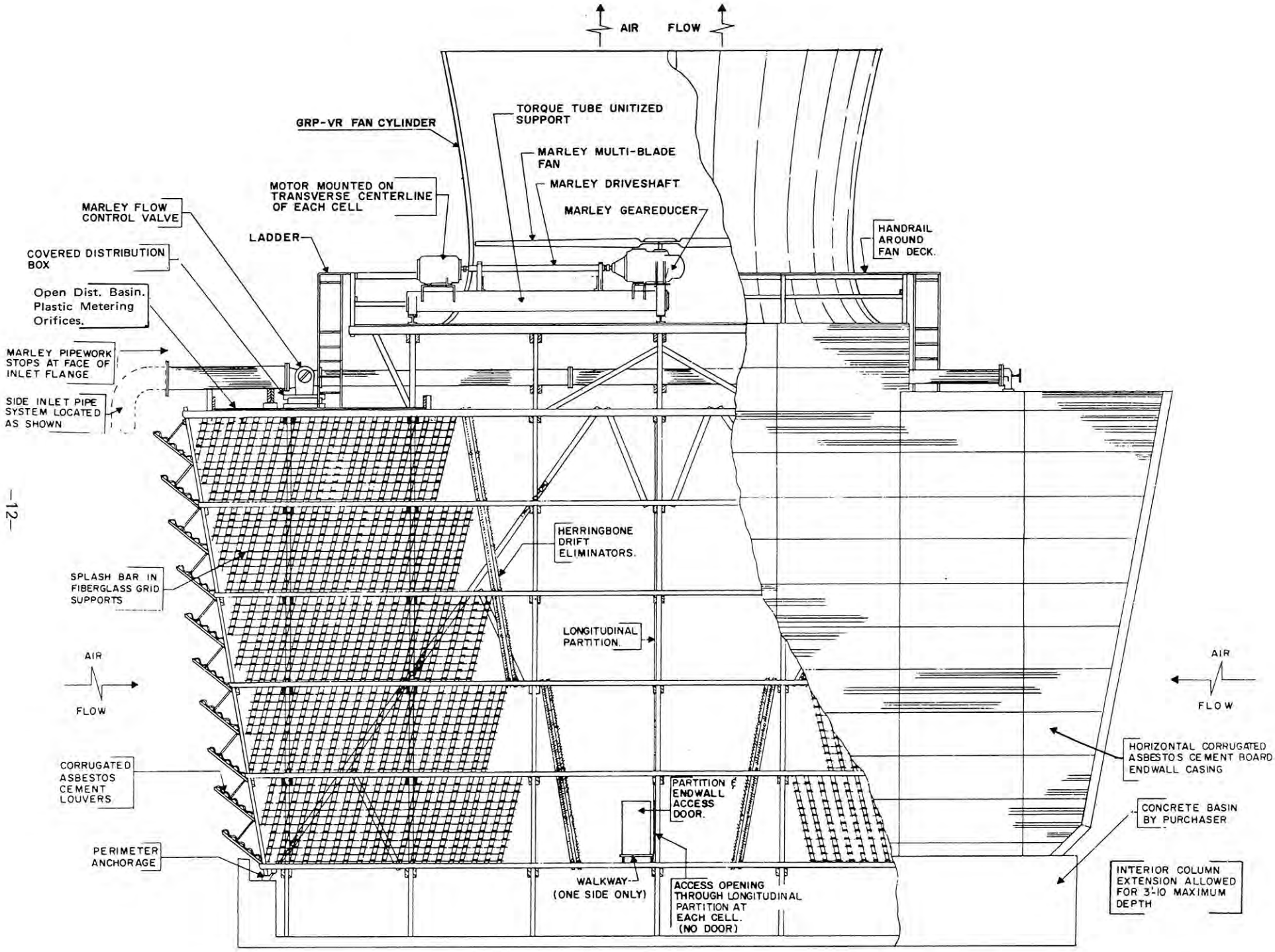
MAINTENANCE WORK REQUIRED:

DESCRIPTION	REQ'D COMPLETION

(Use back of this sheet for additional requirements or notes.)



TRANSVERSE CROSS SECTION OF CLASS 600 SINGLE-FLOW TOWER



TRANSVERSE CROSS SECTION OF CLASS 600 DOUBLE-FLOW TOWER

MARLEY

MANUAL

Series 34, 34.1, 34.2T, 34.3T
GEAREDUCERS

●

Service Manual

NOVEMBER, 1975

SM-34B

5800 Foxridge Drive – P.O. Box 2912 – Mission, Kansas 66201

PRINTED IN U.S.A.

MARLEY

SERIES 34, 34.1 34.2T & 34.3T GEAREDUCERS®
SERVICE MANUAL

PROTECTION AGAINST CORROSION

As shipped from the Marley factory, Geareducers are protected against corrosion with enamels and rust-proofing oil and grease. These oil and grease coatings normally protect the Geareducer for storage periods of six months. However, if oil is put into the Geareducer, it will dissolve the rust-proofing grease and oil, thus requiring the Geareducer to be run once a week in order to keep a protective coating of oil on all interior machined surfaces. See "Seasonal Shutdown" section of this manual for information about nonoperating period maintenance.

Check Geareducer exterior yearly. Touch up with paint as required. Exposed pipe threads are coated to prevent corrosion. Touch up coating as required.

INITIAL OPERATION

Check all assembly bolts and cap screws for tightness. Geareducer vent or vent line must be open to prevent failure of pinion shaft oil seal. In order to check vent line, disconnect it and run a wire through it or blow air through it.

Check mechanical equipment anchor bolts, drive shaft coupling bolts, and coupling set screws and tighten as required.

Geareducers supplied with new towers include oil for the initial filling. *Before operating the mechanical equipment, check to be sure the oil level is at the full mark at the Geareducer and that the external sight glass placard full mark corresponds with the full level in the Geareducer. Check oil lines to be sure there are no leaks and all joints are tight.*

After the first week of operation, the original lubricating oil should be replaced. See "Service and Lubrication" section, page 3 for instructions for changing oil.

Lubricating oil is not furnished with Geareducers supplied as spares or on replacement orders. See list of suggested lubricants on page 6 and "Service and Lubrication" section, page 3 for oil filling instructions.

After the Geareducer has been filled to the full mark at the Geareducer, make sure there are no oil leaks. Check to be sure the oil full mark at the external sight glass placard corresponds with the full level in the Geareducer.

SEASONAL SHUTDOWN
(one week to three months)

1. *At start* of shutdown periods, operate Geareducer until oil is warm (120°F); then stop it and change the oil. See section on Lubrication.

2. *Each week,* drain any water condensation from the lowest point of the Geareducer and its oil system. Check the oil level and add oil if necessary. Operate the Geareducer long enough to recoat all the interior surfaces with oil.

3. *To put back into operation,* drain water condensate and check oil level. Add oil if necessary.

For longer periods of shutdown, see Marley "Instruction Manual for Shutdown of Mechanical Draft Cooling Towers".

INSPECTION OF INTERNAL PARTS

Remove the inspection cover plate from the side of the Geareducer case at each oil change. Check inside of Geareducer for cleanliness of case and internal parts. If any sludge is present, flush inside of Geareducer and connecting oil system.

Also at this time, observe the contact pattern of the gear teeth to see if they appear as illustrated on page 5. If incorrect gear tooth pattern should occur, refer to Marley Field Repair Manual for Series 34, 34.1 & 34.2T, or 34.3T Geareducers.

SERIES 32, 34, 36 AND 38 GEAREDUCERS
SERVICE AND LUBRICATION

The horizontal part of the oil gage and drain line must be level or slightly lower at the sight glass than it is at the Geareducer. The oil capacity of Series 32 Geareducers is 9 gallons. The oil capacity of Series 34, 36 and 38 Geareducers is 18½ gallons. The oil capacity of the optional oil filter is one additional gallon. Connecting oil gage and drain lines require approximately one gallon of oil. Refer to Table I for suggested lubricants.

Fill the Geareducer and gage and drain line system with oil, using one of the following procedures:

Recommended procedure:

1. Pour oil through fill hole in Geareducer inspection cover until it reaches height of "full" mark in the Geareducer case and at the sight glass. See Figures 1 and 3.
2. Start fan drive. Run for one minute.
3. Stop the Geareducer. Allow ten minutes for oil level to stabilize and recheck oil level at Geareducer.
4. If necessary, repeat steps 2 and 3 until stabilized oil level is at the proper height.
5. Check placard location. "Full" mark on placard must be at same elevation as "full" mark on Geareducer.

Alternate procedure:

If the cooling tower is Class 600 or Class 700 and the Geareducer has external oil gage and drain line equipped with three-way valve below sight glass the following alternate procedure may be used:

1. Remove pipe plug. Turn valve control stem clockwise to open drain. Collect used oil in an appropriate container.
2. With Geareducer drained, the three-way valve turned clockwise, and the pipe plug removed, connect fill source, either a street ell and stand pipe of sufficient length to extend above top of the sight glass or a hose to a pump, to the three-way valve.
   Pour oil through a funnel and stand pipe, or pump oil through the hose. Check oil level occasionally by turning the valve control stem counterclockwise and allowing the oil level in the sight glass to stabilize.
   Continue filling until full level mark is reached.
3. With the oil level at the full mark turn the valve control stem counterclockwise to close the drain and open the valve to the sight glass. Remove the oil filling line and reinstall pipe plug in the three-way valve.

Regardless of the procedure used, the Geareducer must be filled to the full mark on the Geareducer.

Maintenance of the Geareducer should be scheduled as follows:

WEEKLY: Check oil level at least once a week using the following procedure:

Stop the Geareducer. Allow ten minutes for oil level to stabilize and check oil level at sight glass. If needed, add oil to Geareducer. If oil is added, repeat steps 2 and 3 of recommended procedure until stabilized oil level is at the proper height.

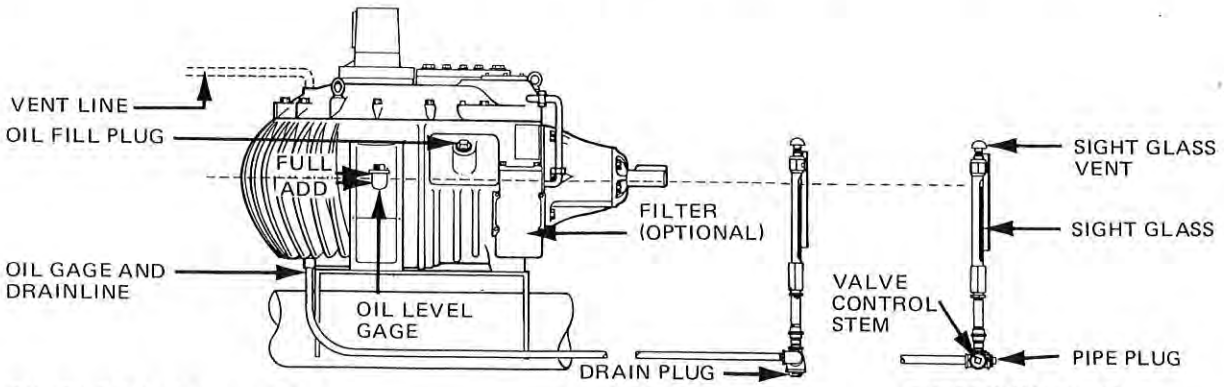
MONTHLY: Check oil monthly for condensation and sludge. Wait 30 minutes after shutdown of Geareducer; then drain 1½ gallons of oil at the drain plug below the sight glass. This is the oil from the connecting oil lines. Take an additional oil sample from the drain plug. This is oil from inside the Geareducer case. Replace oil to "full" mark on Geareducer.

To check for condensation, heat a metal plate to 300-350°F, and place a few drops of the oil sample on it. If the oil boils and foams, it indicates the presence of water. If it merely spreads out and smokes, there is no water present.

To check for sludge, place a few drops of the oil sample on a clean white blotter. If sludge is present, it will leave a ring on the blotter. This residue will approximate the amount of foreign matter contained in the oil.

If Geareducer has optional oil filter, examine filter cartridge. Unscrew the cap screws and remove filter case cap. Inspect the outside of the filter cartridge. If the filter is not dirty, reassemble and refill the system with oil. If it is dirty, the cartridge must be replaced. See page 4 for filter cartridge replacement instructions. If the cartridge is exceptionally dirty, inspect the inside of the Geareducer for sludge. If sludge is in the Geareducer case, drain and flush the entire system. See Fig. 1.

SEMI-YEARLY: Change oil at least every 6 months or 3,000 hours of operation. Refer to recommended oil fill procedure. If condensation or sludge is noted, flush out the Geareducer immediately and change the oil. The oil filter cartridge should be replaced at every oil change.



OIL GAGE AND DRAIN LINE
FIGURE 1.
(Series 36 Geareducer illustrated)

OIL FILTER SERVICE

To replace the filter cartridge, first drain the oil from the Geareducer case, then remove the drain plug from the oil filter case. See Fig. 2.

1. Remove the four cap screws attaching the oil filter case cap, and remove cap.
2. Remove and discard oil filter cartridge. Retain cartridge retainer washer and nut for re-installation.
3. Clean gasket material from filter case and cap.
4. Wash inside of filter case, cap and filter hardware with kerosene.
5. Install new filter cartridge. Reinstall cartridge retainer washer and nut. Install new cap gasket and reinstall filter case cap.
6. Coat drain plug threads with Permatex Pipe Joint Compound No. 51 or equal. Reinstall drain plug and tighten securely.
7. After refilling unit with oil and operating unit, check all gasketed joints for oil seepage. Tighten flange bolts if necessary.

Check the oil level placard location each time the oil is changed. The "full" mark on the placard must be at the same elevation as the "full" arrow on the side of the Geareducer case; see Figures 1 and 3.

Sight glass vent must be kept open. Inspect at each oil change and clean when necessary. Inspect internal parts and inside of Geareducer case at each oil change – see section on inspection of internal parts. Use oil recommended in Table I for the proper atmospheric temperature range.

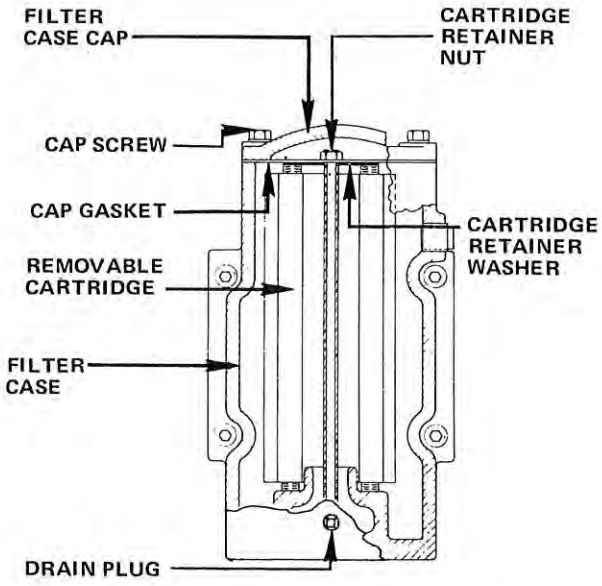


Fig. 2. Cross section of oil filter.

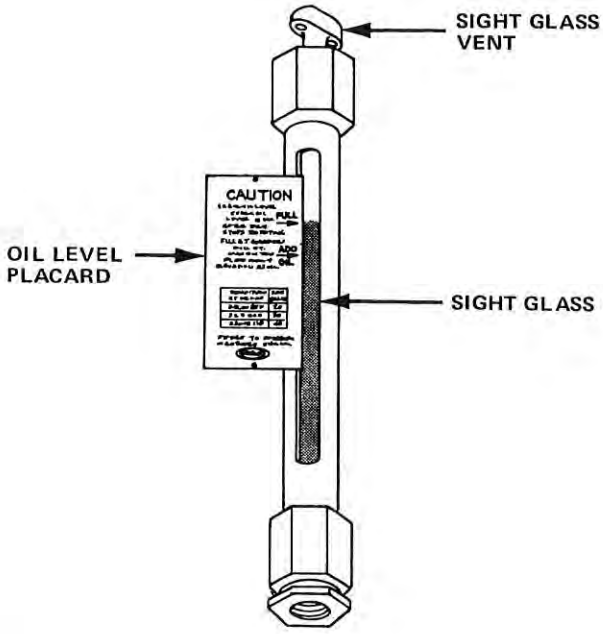
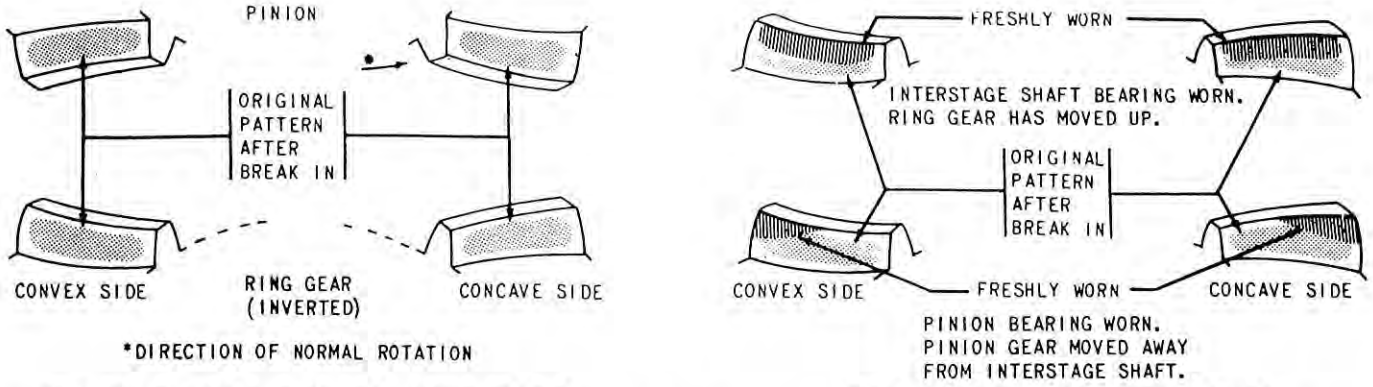
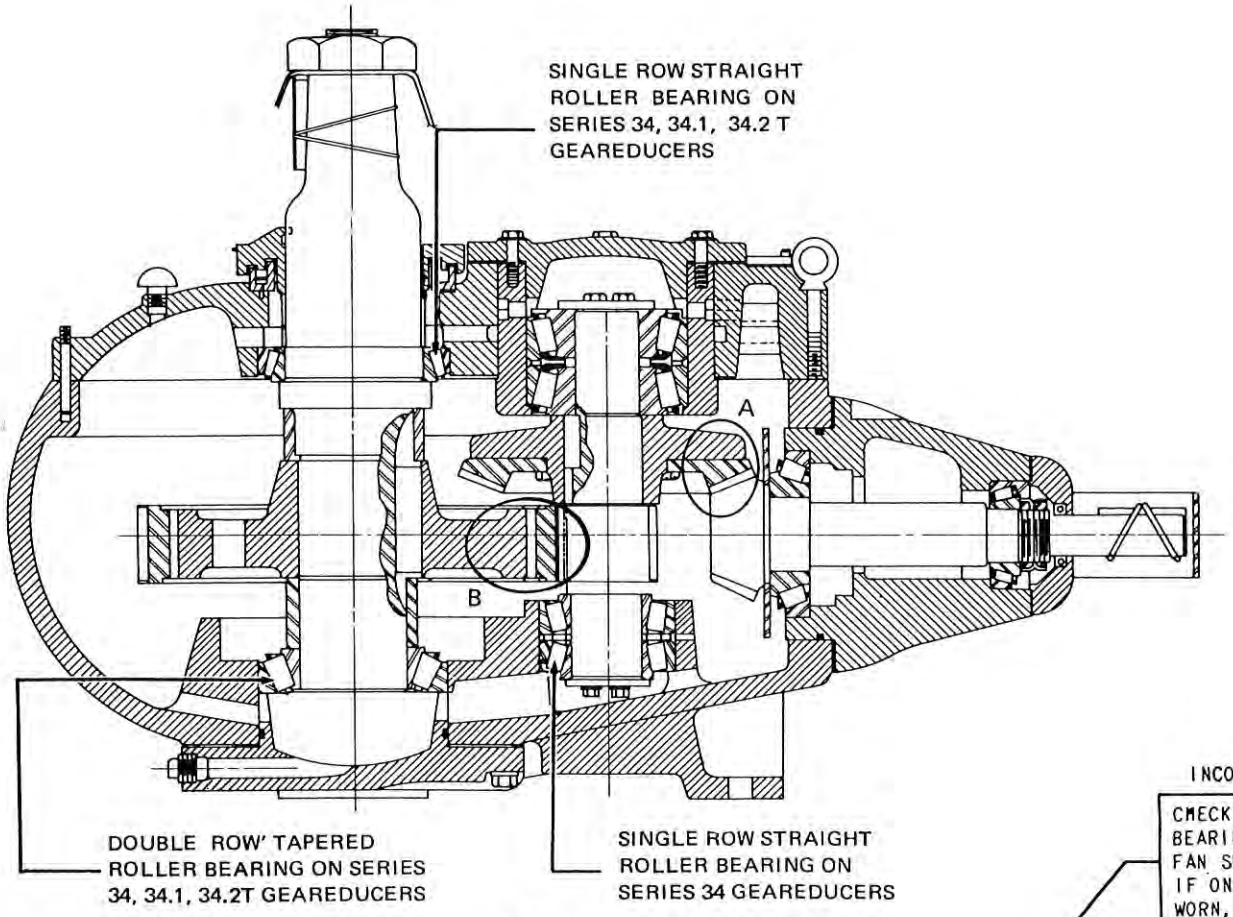


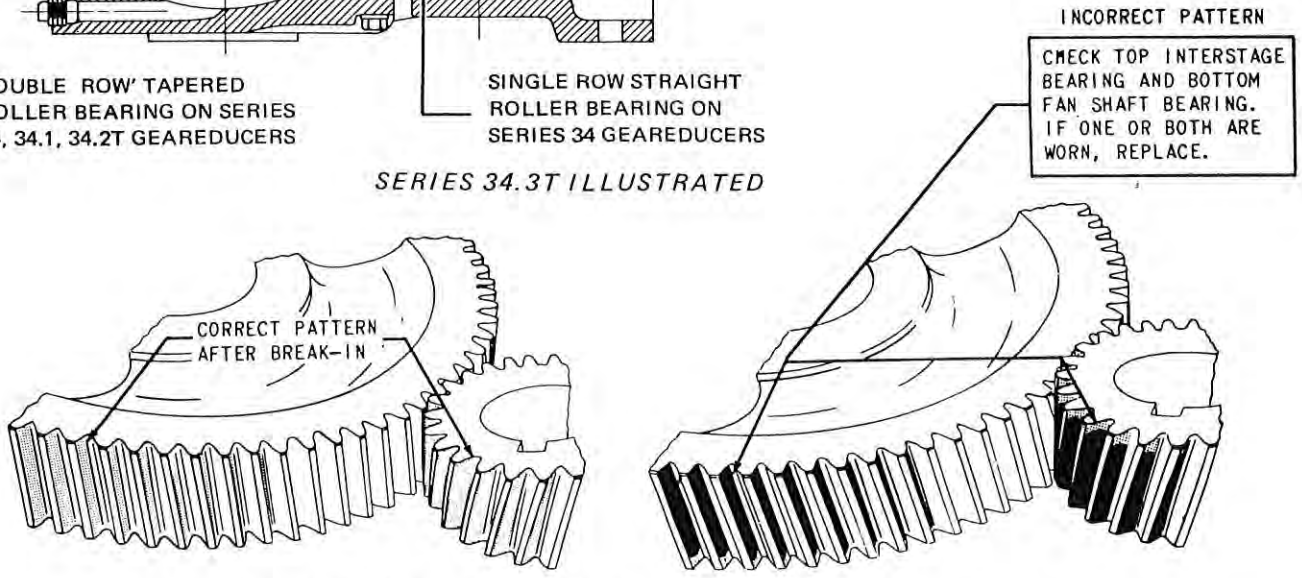
Fig. 3 Sight glass assembly.



Detail A – Spiral Bevel Gear Tooth Pattern



SERIES 34.3T ILLUSTRATED



Detail B – Helical Gear Tooth Pattern

TABLE I
TURBINE-TYPE MINERAL OILS FOR SPIRAL-BEVEL GEAREDUCERS

Listed below are typical turbine type mineral oils recommended for use in Marley Spiral Bevel Geareducers by the companies shown. Seasonal temperature changes require one viscosity of oil for summer operation and another for winter operation. If it is necessary to use any oil which is not listed in this table, that oil must not contain any additives which are adversely affected by moisture. The responsibility for use of lubricants other than those listed below lies with the customer/user and the lubricant supplier.

	AIR TEMPERATURE AT GEAREDUCER		
MANUFACTURER	**WINTER** Below 32°F **SAE 20** Viscosity S.U.S. At 100°F 230-310	**WINTER or SUMMER** 32°F to 110°F **SAE 30** Viscosity S.U.S. At 100°F 450-610	**SUMMER** Above 110°F **SAE 40** Viscosity S.U.S. At 100°F 750-1000
	LUBRICANT DESIGNATION		
American Oil Co.	American Ind. Oil No. 31	American Ind. Oil No. 51	American Ind. Oil No. 95
Ashland Pet. Co.	Ashland ETC Oil K-30	Ashland ETC Oil K-50	Ashland ETC Oil K-75
Atlantic Richfield Co. (ARCO)	Rubilene S-315	Rubilene 550	Rubilene S-700
Borne-Scrymser Co.	Turbo Gear Oil	Paragon Engine Oil	Bornes Motor Oil No.50L
Chevron Oil Co.	Chevron OC Turbine Oil 68	Chevron OC Turbine Oil 150	Chevron OC Turbine Oil 220
Cities Service Co. (CITGO)	Citgo Pacemaker T-30	Citgo Pacemaker T-50	Citgo Pacemaker T-80
Continental Oil Co.	Dectol 33 R&O	Dectol 51 R&O	Dectol 76 R&O
Dryden Oil Co.	Sulgrave 2 Paradene 430	Sulgrave 3 Paradene 450	Sulgrave 4 Paradene 490
Exxon	Nuto 53 Teresso 52	Nuto 63 Teresso 65	Nuto 76 Teresso 85
Farmland Ind., Inc.	Co-op Indol 5	Co-op Indol 7	Co-op Indol 9
Gulf Oil Corp.	Gulf Harmony 53	Gulf Harmony 69	Gulf Harmony 77
Imperial Oil, Ltd.	Teresso 52	Teresso 65	Teresso 85
Keystone Precision Lubricants	KLC No. 5	KLC No. 4	KLC No. 3
Lion Oil Co.	Azalea T-2 Azalea C	Azalea T-3 Azalea D	Azalea T-4 Azalea E
Mobil Oil Corp	DTE 26	DTE Ex. Hvy.	DTE BB
National Ref. Co.	Enarco ETC Oil K30	Enarco ETC Oil K50	Enarco ETC Oil K75
Pennzoil Co.	Hyd. Oil No. 3	Hyd. Oil No. 5	Hyd. Oil No. 7
Phillips Petroleum Co.	MM Motor Oil 4020	MM Motor Oil 4030	MM Motor Oil 4040
Shell Oil Co.	Shell Tellus Oil 33	Shell Tellus Oil 69	Shell Tellus Oil 71
Skelly Oil Co.	Skelvis SAE 20	Skelvis SAE 30	Skelvis SAE 50
Standard Oil of Indiana	Amer. Ind. Oil No. 31	Amer. Ind. Oil No. 51	Amer. Ind. Oil No. 95
Standard Oil of Ohio	Factovis 52	Factovis 65	Factovis 80
Sun Oil Co.	Sunvis 931 Sun R&O 300	Sunvis 951 Sun R&O 500	Sunvis 999 Sun R&O 950
Sunray DX Oil Co.	562	563	564
The Texas Co. (TEXACO)	Regal Oil C (R&O)	Regal Oil F (R&O)	Regal Oil G (R&O)
Tidewater Oil Co.	Veedol Aturbrio 60	Veedol Aturbrio 71	Veedol Aturbrio 77
Union Oil of Calif. (East)	UNAX RX 315	UNAX RX 465	UNAX RX 700
Union Oil of Calif. (West)	Turbine Oil 315	Turbine Oil 465	Turbine Oil 1000
Valvoline Oil Co.	Valvoline ETC Oil K-30	Valvoline ETC Oil K-50	Valvoline ETC Oil K-75

REPAIR AND OVERHAUL

When repair or replacement parts are required, Marley recommends that the Geareducer be returned to its plant in Olathe, Kansas in exchange for a factory reconditioned unit. Obtain "Customer Return Material" tag from Marley sales office or representative to affix to the Geareducer for return.

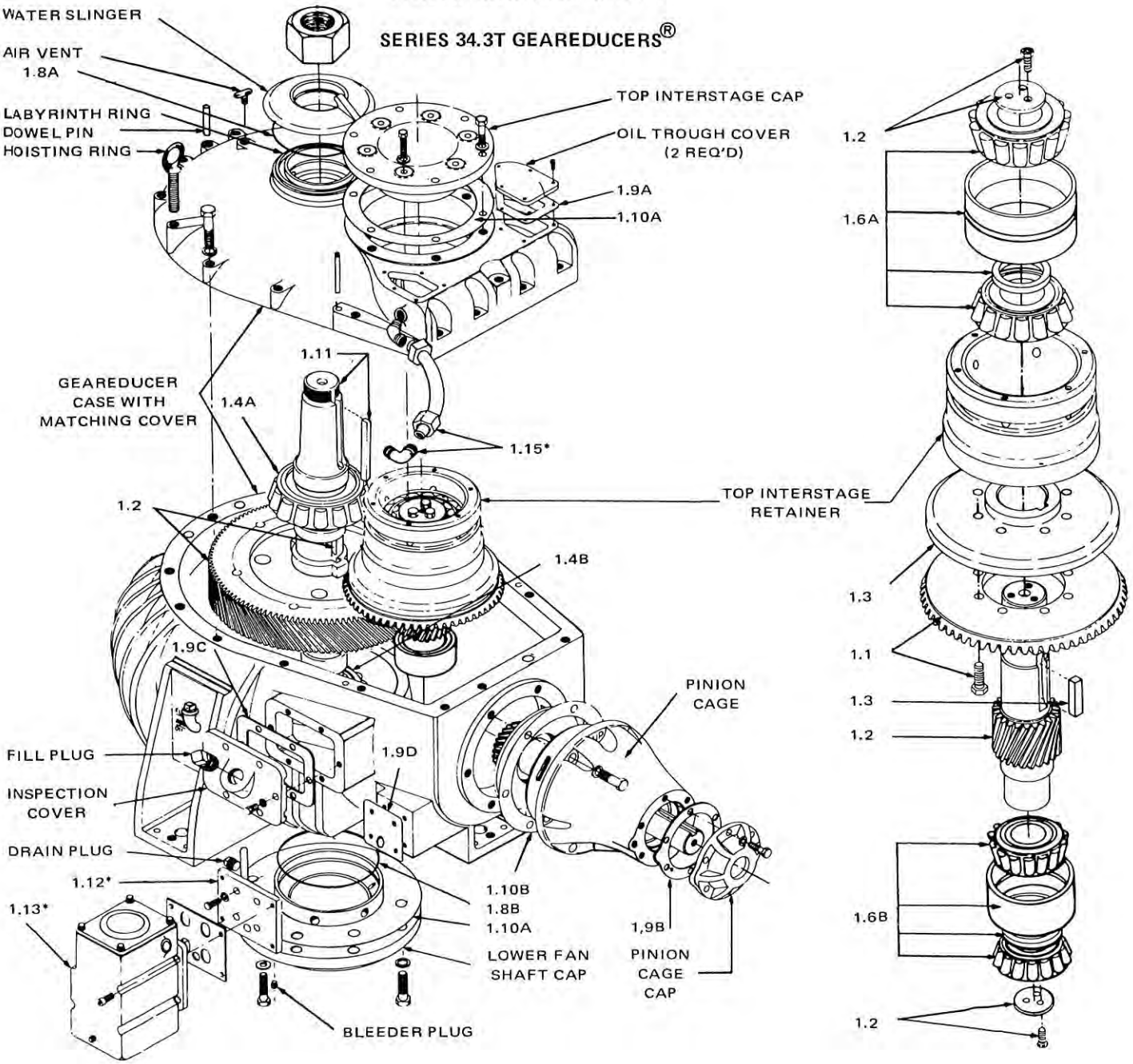
A factory reconditioned Geareducer carries the same one year guarantee against defects in material and workmanship as does a new unit.

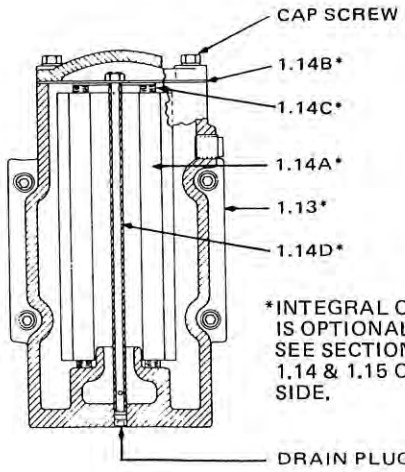
Geareducers can be repaired in the field, however, major repairs require the use of a fully equipped machine shop. If field repair or overhaul is preferred refer to Geareducer Parts Manual sheets for parts required. Field repair instructions are available from Marley on request. Contact the Marley sales office or Marley representative in your area for information.

MARLEY

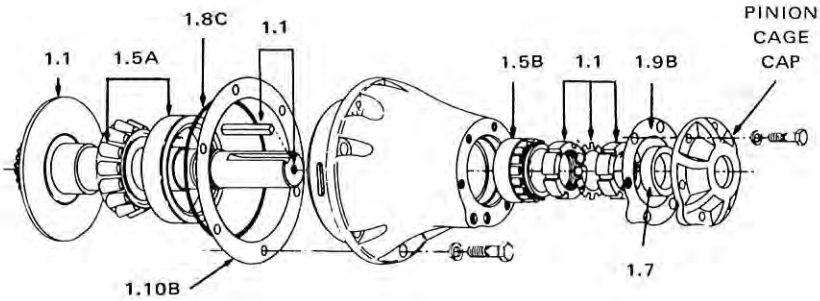
PARTS MANUAL SHEET

SERIES 34.3T GEAREDUCERS®





*INTEGRAL OIL FILTER IS OPTIONAL EQUIPMENT SEE SECTIONS 1.12, 1.13, 1.14 & 1.15 ON REVERSE SIDE.



REPLACEMENT PARTS

1. 0 **COMPLETE GEAREDUCER ASSEMBLY,** ready for installation.

***1. 1 **SET OF MATCHED SPIRAL BEVEL GEARS** with pinion shaft, oil slinger, locknuts, lock washer and place bolts.

*****1. 2 **SET OF MATCHED HELICAL GEARS** with interstage shaft, discs, place bolts and lower fan shaft key.

***1. 3 **SPIRAL BEVEL GEAR HUB AND KEY.**

1. 4 **FAN SHAFT BEARINGS, SET OF TWO.**
   - A. Upper, tapered roller bearing, Timken No. 46790-46720 or equal.
   - B. Lower, tapered roller bearing, Timken No. 95500-95925 or equal.

1. 5 **PINION SHAFT BEARINGS, SET OF TWO.**
   - A. Head, tapered roller bearings, Timken No. 98350-98788 or equal.
   - B. Tail, tapered roller bearing, Timken No. HM813844-HM813810 or equal.

1. 6 **INTERSTAGE BEARINGS, SET OF TWO.**
   - * A. Upper, double row, tapered roller bearing (matched assembly with cone spacer)
   - * B. Lower, double row, tapered roller bearing (matched assembly with cone spacer)

1. 7 **PINION SHAFT OIL RETAINER,** Chicago Rawhide No. 23650 or equal.

1. 8 **SET OF MOLDED SYNTHETIC RUBBER "O - RING" SEALS.**
   - A. Water slinger seal.
   - B. Lower fan shaft cap seal.
   - C. Pinion cage seal.

*1. 9 **SET OF GASKETS.**
   - A. Oil trough cover, (two required)
   - B. Pinion cage cap gasket.
   - C. Inspection hole gasket.
   - D. Oil return opening.

*1.10 **KIT OF ASSORTED SHIMS.**
   - A. Fan shaft and interstage shaft shims.
   - B. Pinion cage shims.

***1.11 **FAN SHAFT ASSEMBLY,** complete with jam nut, key, and spacers.

1.12 **OIL RETURN ASSEMBLY,** Marley Pt. No. 69-260-1 complete with gasket and mounting bolts.

1.13 **OIL FILTER ASSEMBLY,** Marley Pt. No. 9-4282-2 complete with gasket and mounting bolts.

1.14 **FILTER CARTIDGE ASSEMBLY.**
   - A. Replacement cartridge, Bowser BP-509-W or equal, Bowser-Briggs Filtration Division, Bowser Inc.
   - * B. Cap gasket.
   - C. Washer, steel.
   - D. Center pipe and nut.

1.15 **OIL FILTER SUPPLY TUBE, COMPLETE WITH FITTINGS.**

* Must be obtained from Marley.

** Overall gear ratio of 13.00 to 1, 11.18 to 1, 10.285 to 1 or 8.85 to 1 must be noted when ordering replacement parts.

*** Keys included in items 1.2, 1.3 and 1.11 are high strength alloy steel keys. These keys must be obtained from The Marley Company.

When ordering parts, always mention tower serial number, serial number of Geareducer and model number of Geareducer. Contact the Marley sales office or Marley representative in your area for assistance.

SERVICE MANUAL

ASSEMBLY, PITCHING AND MAINTENANCE

289" Through 336" Diameter HP-4 Marley Fans

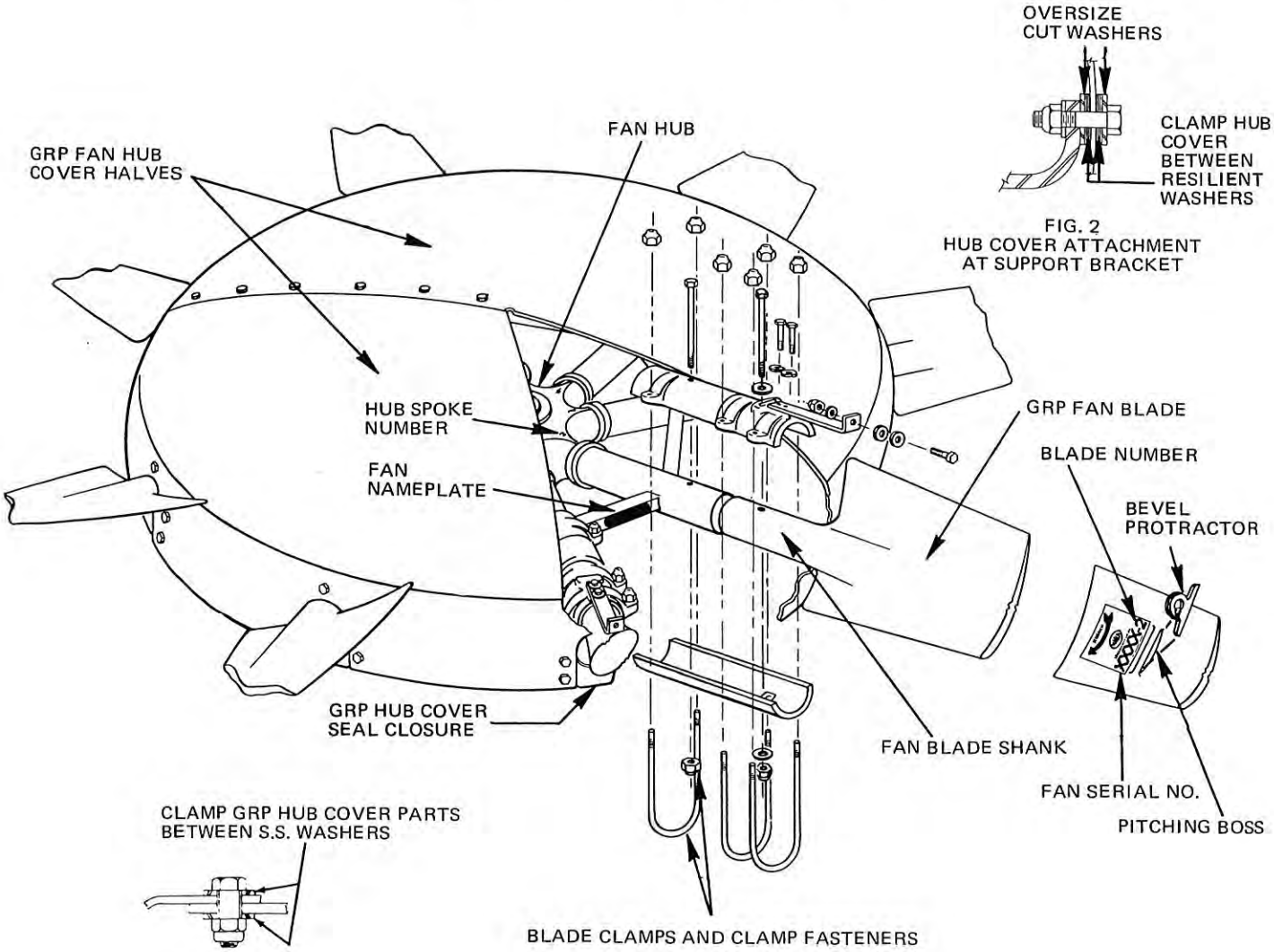
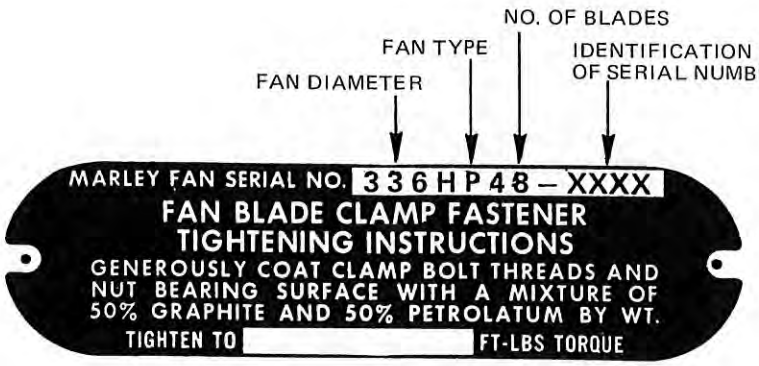


FIG. 1
(GRP HUB COVER JOINT)

FIG. 2
HUB COVER ATTACHMENT AT SUPPORT BRACKET



TYPICAL FAN NAMEPLATE

Marley Order No. _____

Fan Diameter _____

Trial Pitch Angle _____

Final Pitch Angle _____

Speed, rpm _____

Contract Hp _____

IMPORTANT – Each fan is statically balanced at the factory as an assembly. The fan hub is identified with the complete serial number and each socket is identified by number. Each blade is marked with the identification portion of the fan serial number and a number indicating the blade's position in the hub.

FAN ASSEMBLY

1. Make certain that the identification number on each blade corresponds to the identification number in the fan assembly serial number on the nameplate.
2. U-bolt and thru-bolt threads and washer face of self locking nuts are lubricated at the factory prior to shipment. If necessary, to insure a generous coating, touch up all threads and nut washer surfaces using lubricant supplied with fan.
3. Check to make sure No. 1 blade and clamps go onto number 1 spoke, No. 2 blade and clamps go onto number 2 spoke, and so on around the fan.
4. There is an arrow on each fan blade showing direction of fan rotation. This arrow must be on the air discharge side of the fan.
5. Be certain that each blade is as far from the center of the fan as the thru bolts in the blade shank and hub spoke will permit. This is necessary in order to maintain proper balance.
6. Support blade tips in a horizontal plan when U-bolts are tightened. Hold each blade at the proper pitch angle when tightening.
7. Total vertical tip track variation should not exceed 2 inches (±1 inch from the reference plane of fan rotation). Excessive track will cause dynamic imbalance.

SETTING FAN BLADE PITCH

1. The trial pitch angle is the calculated setting for design conditions (water rate, heat load, air density, and brake horsepower). Set the bevel protractor at the trial pitch angle supplied by The Marley Company and pitch all the blades to the same angle. All blades must be pitched to the same angle when each blade is pointing in the same direction in the fan cylinder.
2. Tighten the thru-bolt and U-bolt self locking nuts to 70 ft./lbs. torque (120 ft./lbs. if stainless steel).
3. Recheck the pitch of each blade, as pitch might change while tightening nuts.

HUB COVER INSTALLATION

1. Bolt hub cover halves together as shown in Fig. 1. Tighten nuts to 10-15 ft./lbs. torque.
2. Install hub cover sub-assembly on hub, attaching it to support brackets as shown in Fig. 2. Tighten nuts to 10-15 ft./lbs. torque.
3. Install seal closures, and tighten nuts to 10-15 ft./lbs. torque.

CHECKING LOAD AT MOTOR

1. Operate the fan until motor and Geareducer have reached operating temperature (approximately 30 minutes of operation). Take operating voltage and amperage measurements for use in calculating motor HP by the following equation.*

$$HP = \frac{\text{actual volts} \times \text{actual amps}}{\text{nameplate volts} \times \text{nameplate amps}} \times \text{nameplate HP}$$

2. The calculated horsepower should equal but not exceed the contract horsepower specified by The Marley Company. Measurements used in above calculations must be made with hot water flowing through the tower. Repitch blades as required to obtain contract horsepower. Measurements made with no water or cold water will result in an erroneous calculated horsepower.
3. A one degree change in blade pitch will vary the power (HP) required by these values.

		POWER VARIATION AT GEAREDUCER RATIO						
GRDR.	MOTOR SPEED	13.00/1	11.55/1	11.18/1	10.83/1	10.28/1	9.64/1	8.85/1
34.3T	1200	2.3	–	4.3	–	7.1	–	9.8
	1500	7.1	–	9.8	–	–	–	–
	1800	10.0	–	–	–	–	–	–
36	1200	–	3.5	–	6.0	–	8.3	–
	1500	7.1	9.6	–	11.9	–	–	–
	1800	11.9	–	–	–	–	–	–

4. If blades are repitched, self-locking nuts must be retightened to 70 ft./lbs. torque (120 ft./lbs. if stainless steel).

FAN REBALANCE

1. Replacement blades can be installed requiring only minimal field rebalancing in fans assembled since 1957. When ordering a replacement blade, give the fan serial number and blade number, so that the balancing moment of the new blade may be matched as closely as possible to the recorded moment of the original blade.
2. If rebalance is required, trial and error attachment of balance weights at various locations on the hub spoke braces might produce a satisfactory dynamic balance with the fan operating on the tower.* If this is not satisfactory, it is recommended that the complete fan assembly be returned to The Marley Company at Olathe, Kansas for selection of replacement parts and factory rebalance. If this is not possible, the fan assembly can be statically rebalanced as follows:
   A. Fan assembly should be mounted on a suitable mandrel matching the hub bore, and the mandrel placed on knife wheels or level, parallel bars with the fan blades in a vertical plane. This must be done in a draft-free area.
   B. Apply balance weights at selected locations at spoke braces until all tendency for fan to rotate is overcome. This is accomplished by allowing the fan assembly to rotate freely on the knives until it comes to rest with the heaviest portion at the bottom. Manually rotate the fan 90^{0} so that the heaviest portion is at either side of the fan centerline. Add weights to the light side on the spoke braces.
   C. If one or more blades are replaced, relocating some of the blades in other sockets might simplify balance and result in fewer balance weights being required.

FAN MAINTENANCE

1. Check tightness of blade clamp hardware after the first week of operation, during Geareducer oil change, and at intervals of not more than six months.
2. A periodic (monthly) inspection of the fan should be made to assure continued trouble free operation. Any accumulation of dirt or scale deposits on the fan should be carefully and completely removed to maintain accurate balance. Preventive maintenance to control corrosive attack will prolong the useful life.
3. If it is necessary to disassemble the fan for any reason, blade clamp bolt threads and nut bearing surfaces must be re-coated with lubricant consisting of 50% petrolatum and 50% graphite by weight and tightened to the torque limits shown.

MECHANICAL SERVICE

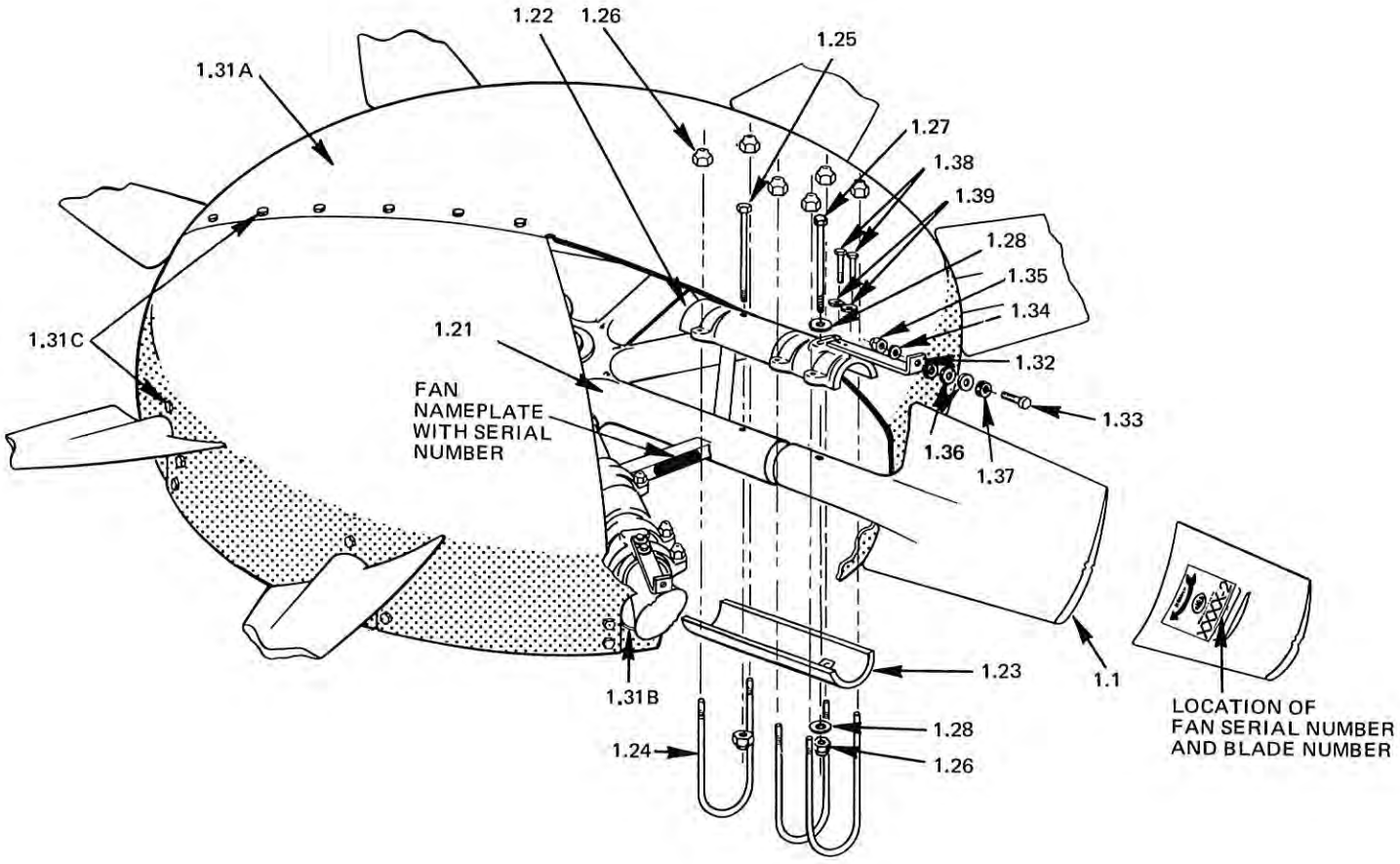
When writing The Marley Company for repair or replacement parts, please refer to the order number and fan serial number; also state diameter of fan and number of blades.

*CAUTION: When checking and/or changing blade pitch or cycling fan in normal operation, do not exceed 30 sec./hour total motor starting time as motor may be overheated.

PARTS MANUAL SHEET

TYPE HP-4 GLASS REINFORCED POLYESTER BLADE FANS

289" Through 336" Diameter 8 Blade Fans



REPLACEMENT PARTS

1.0 COMPLETE FAN ASSEMBLY (Factory Balanced)

- **1.1 FAN BLADE**
- **1.2 FAN HUB ASSEMBLY**
  - 1.21 Fan Hub
  - 1.22 Top Blade Clamp
  - 1.23 Bottom Blade Clamp
  - 1.24 U-Bolt
  - 1.25 Thru Bolt, Inboard
  - 1.26 Self Locking Nut
  - 1.27 Thru Bolt, Outboard
  - 1.28 Washer

- **1.3 HUB COVER & ATTACHING HARDWARE**
  - 1.31A Cover Segment
  - 1.31B Seal Closure
  - 1.31C Bolt, Washers and Self Locking Nut
  - 1.32 Seal Support Bracket
  - 1.33 Bolt
  - 1.34 Washer
  - 1.35 Self Locking Nut
  - 1.36 Resilient Washer
  - 1.37 Oversize Washer
  - 1.38 Capscrew
  - 1.39 Lockwasher

Refer To Fan Service Manual Before Ordering Parts. Order Should Include The Following Information:

1. Fan serial number (from nameplate).
2. Item number, description and quantity of parts required.
3. If blades are ordered, include original blade numbers.
4. Original Marley order number or tower serial number.

Contact your Marley Sales Office or Representative for Assistance on Order Placement

MARLEY

MANUAL

Series 301
Drive Shaft

Installation, Operation

and

Maintenance Instructions

NOVEMBER, 1976

SM-301D

5800 Foxridge Drive – P.O. Box 2912 – Mission, Kansas 66201

PRINTED IN U.S.A.

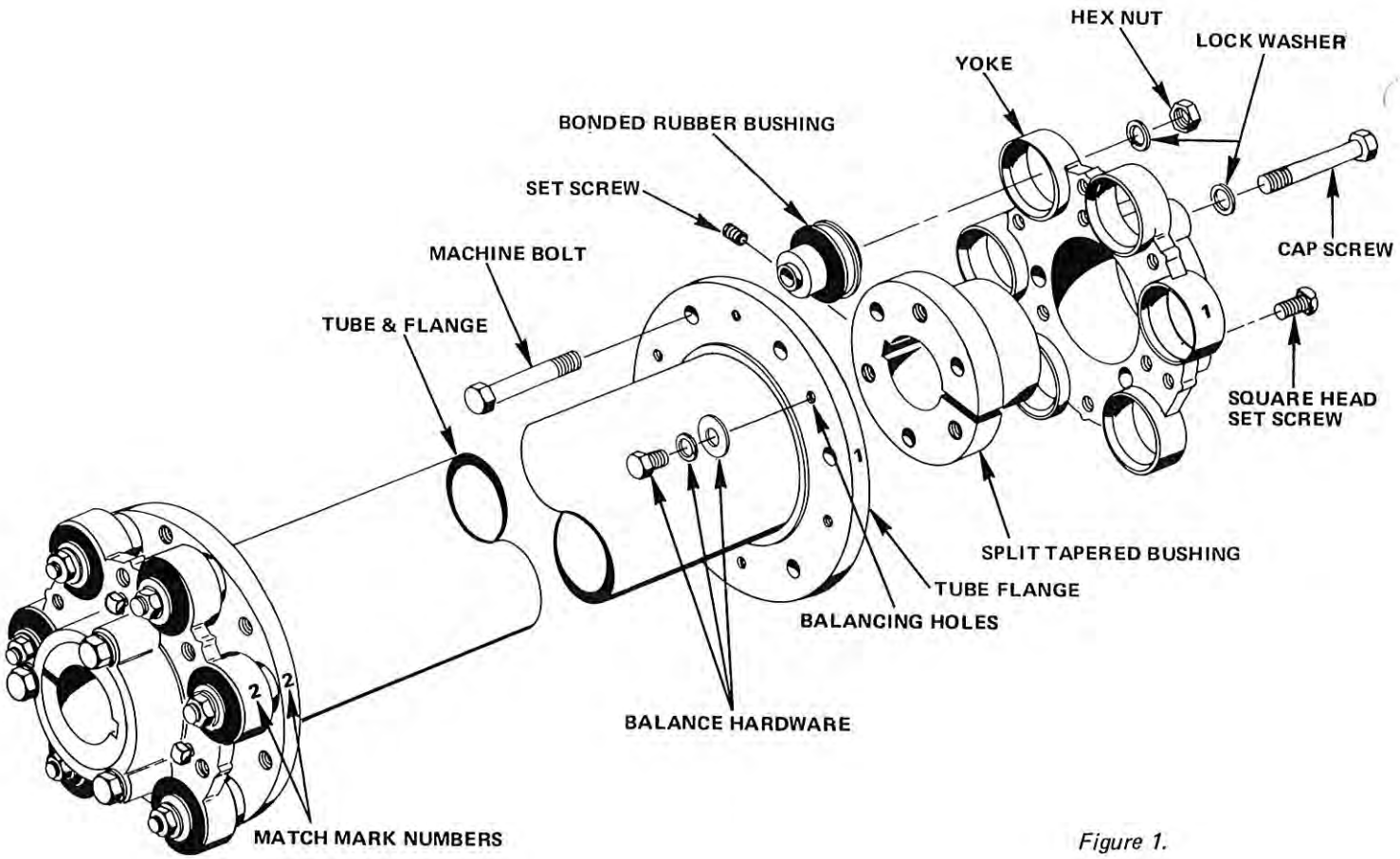


Figure 1.

GENERAL

The Marley Series 301 Drive Shaft Assembly is comprised of the following:

1. Tube and flange assembly.
2. Yoke with six rubber bushings and split tapered bushing for each end connection.
3. Assembly and balancing hardware.

The driveshaft is match marked with the numeral 1 on the motor yoke and tube flange, and with the numeral 2 on the Geareducer yoke and tube flange. These match marks denote the correct angular relationship of the parts after they have been dynamically balanced. The match mark relationship must be retained during installation.

INSTALLATION INSTRUCTIONS

ASSEMBLY:
Before installing drive shaft, be sure that motor and Geareducer are on level bases and that their shafts are in reasonable alignment.

"G" dimensions (Figure 3, page 4) are furnished for each new drive shaft on the "Drive Shaft Installation Data Form" (E-2517) included with this manual.

If reusing an existing drive shaft, "G" dimension must be determined per page 4.

A recommended procedure for installing the drive shaft is outlined below:

1. Note match mark numbers on drive shaft.
2. Remove yoke and tapered bushing assemblies.
3. Remove the three cap screws that secure the tapered bushing in the yoke and remove the bushing either by tightening the removal set screws or tapping on the bushing.
4. Coat shaft extensions with Thred-Gard (Crane Packing Co.) or similar rust preventive compound.
5. Coat the tapered surfaces of the bushings with machine oil.
6. Insert key halfway into keyway of Geareducer pinion shaft.
7. Place Geareducer yoke over pinion shaft and slide or tap the tapered bushing onto the pinion shaft (tapered end first) until bushing and key are flush with end of pinion shaft.
8. Tighten tapered bushing set screw against key.
9. Slide yoke onto tapered bushing and progressively tighten the bushing cap screws to 40-60 ft./lbs. torque. *Do not lubricate these three bushing cap screws.*
10. Repeat steps 6, 7 and 8 for opposite motor shaft.
11. Align match marks and fasten Geareducer end of tube

and flange assembly to yoke. Support opposite end of tube and flange assembly during this operation.

12. Slide motor yoke onto tapered bushing.
13. Align match marks on motor yoke and tube flange.
14. Progressively tighten tapered bushing cap screws to 40-60 ft./lbs. torque. Within this range of cap screw torque, the yoke should pull onto the tapered bushing and seat the pilot of the rubber bushings in the tube flange. If the yoke pulls too far or not far enough, either the position of the mechanical equipment or the tapered bushing position on the shafts must be adjusted. Make a preliminary adjustment such that the dimension between the yoke and flange faces is 11/16 ± 1/16".
15. Secure the yokes to the tube flanges with six machine bolts at each end.
16. If, during step 14, either yoke is pulled more than 1/4" off the motor or pinion shaft and the mechanical equipment cannot be moved in 1/4", adjust the entire drive shaft assembly axially to attain the same engagement at both ends.

ALIGNMENT:

A preliminary check on alignment can be made by measuring between the flanges (approximately 11/16") at four points (top, bottom and two sides).

The best way to measure the angular alignment is with a dial indicator. See Marley manual SM-60/350DI for use of a dial indicator in measuring drive shaft alignment. An "Alignment Indicator Kit", part number 72-3968-1 can be purchased from Marley.

Check angular alignment of drive shaft by measuring the variation of distance between the flange and yoke of the couplings during one complete revolution. The final adjustment must be such that the distance between adjacent flanges, measured with a dial indicator installed in one of the balancing holes, does not vary more than .005 during one complete revolution.

Check "G" dimensions (Figure 3) using a depth micrometer. Final average "G" dimensions shall be within ±.010 inches of the "G" dimension given on the "Drive Shaft Installation Data Form" included with this manual or previously determined for an existing drive shaft.

Recheck angular misalignment. Some repetition of the alignment and "G" dimension adjustment procedures might be necessary to achieve the requirements of .005 TIR angular alignment and ±.010 "G" dimension variation.

Tighten all mounting bolts and recheck alignment.

BALANCING

Rebalance drive shafts whenever parts are replaced. Drive shafts may be rebalanced on the tower* by removing the fan on that cell. Use a portable vibration indicator similar to the unit shown in Figure 2 to determine amplitude of vibration in mils.

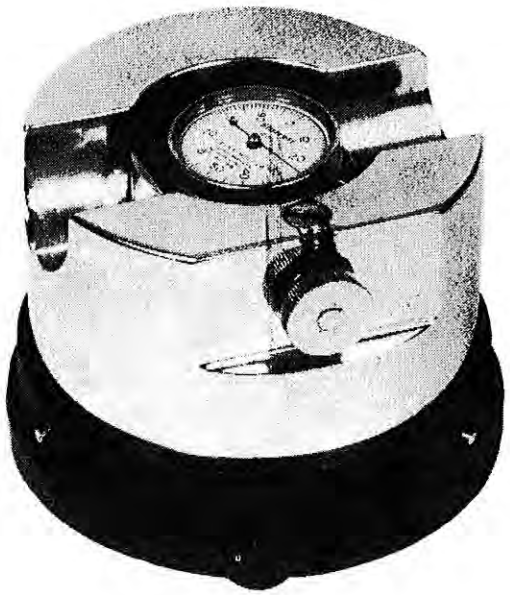


Figure 2. Dial Type Vibration Indicator

*CAUTION: When balancing drive shaft on the tower, do not exceed 30 sec./hour total motor starting time as motor may become overheated.

On towers having more than one fan, take vibrometer readings with the vibrometer dial in a horizontal position on the top of the motor and the Geareducer with all fans operating except the one being tested. These readings indicate the amount of vibration, in a vertical direction, that is being introduced into the cell from other parts of the tower. No attempt should be made to compensate for this vibration within the cell under test.

Start the motor on the cell under test and operate the drive shaft and Geareducer. Take another set of vibrometer readings on the motor and Geareducer. These readings indicate the amount of vibration induced in the cell as noted above, plus the amount of vibration caused by the unbalance of the drive shaft.

Stop all motors on the tower with the exception of the cell under test and take a third set of vibrometer readings. These readings indicate the amount of vibration caused directly by the drive shaft under test and should equal the difference in the first two sets of readings. The vibration indicated by this third set of readings must be corrected by balancing the drive shaft under test. It is normally possible to bring these readings down to .005".

Readings on the vibrometer may be generally brought down below 0.005" TIR by the following method:

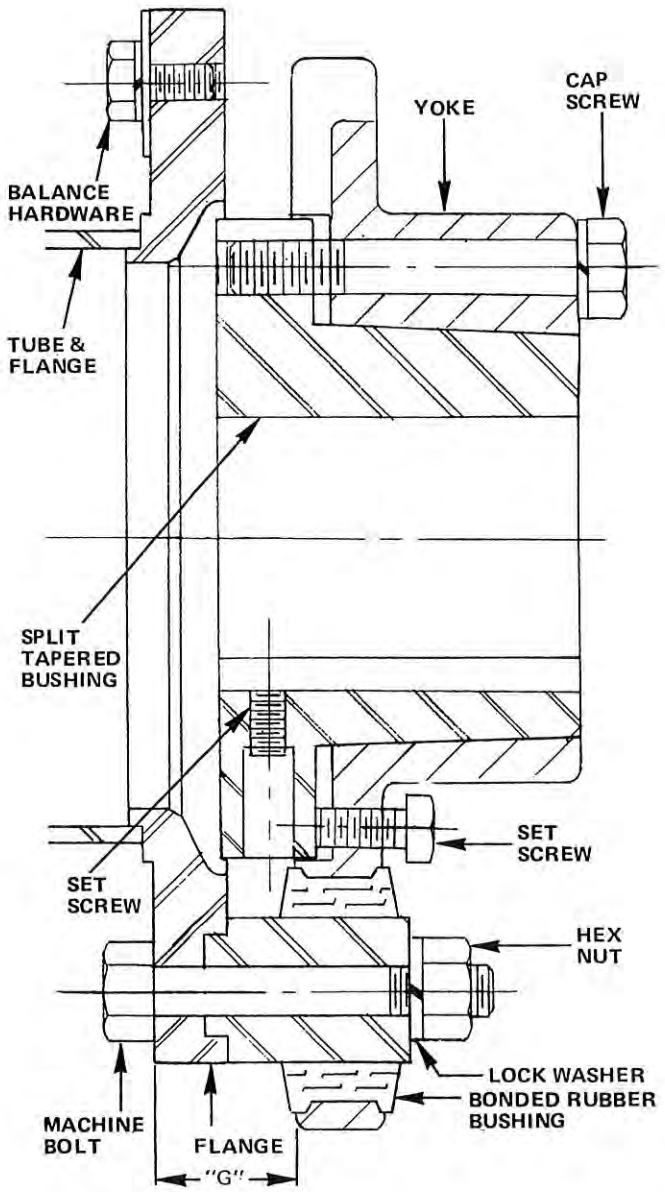


Figure 3. Sectional Details of Drive Shaft Assembly

Add (or remove) washer weight or weights on one of the 3/8" balancing cap screws in drive shaft tube flange, at the motor end *(see Figure 1).* If improvement is made, continue to add (or remove) more weights at the same point. *(NOTE: Adding weights at one point has the same effect as removing similar weights direct-opposite (180°) and vice-versa. This can be used to keep the total weights to a minimum.)* If this increases the vibration, restore original condition and repeat same operation on a balancing cap screw 60° from starting point.

After the motor end is adjusted, repeat same operation on Geareducer end, and recheck the motor end to determine if Geareducer end balance operation has increased motor end vibration reading. If so, repeat balancing of each end until no change in the opposite end is effected.

If a satisfactory balance cannot be obtained, turn the drive shaft tube and flange assembly end for end and repeat the above method. Vibrometer readings should be taken on the motor (with motor yoke installed) when drive shaft is disconnected to determine motor and yoke roughness. If vibrometer readings still indicate roughness, remove the yoke from the motor shaft and repeat the test to determine motor roughness.

If balance to within .005" can not be attained the drive shaft assembly may be returned to Marley's plant at Olathe, Kansas for factory rebalance. Obtain "Customer Return Material" tag from Marley sales office or representative to affix to the drive shaft for return.

DETERMINING "G" DIMENSION

1. Assemble yokes on tube and flange. Be sure to match the numbers on the tube flanges with their respective numbers on the yokes.
2. Support the drive shaft only at two points on the tube at each end just inboard of the flanges. Measure the "G" dimension (Figure 3) at two positions 180° apart and average the two dimensions (add the two measurements together and divide by 2). Do this for both couplings.

MAINTENANCE

Marley Series 301 Drive Shafts do not require lubrication.

Inspection of the complete drive shaft should be made at least every six (6) months. Look for checking or cracking of rubber bushings, looseness of bolts and misalignment of any parts in the flexible shafts. Accurate drive shaft alignment is required to insure maximum service life. Check alignment as outlined in preceding section on "Alignment". Repair or replace drive shaft parts as necessary. Replacement parts are available as listed in the Marley Parts Manual sheet.

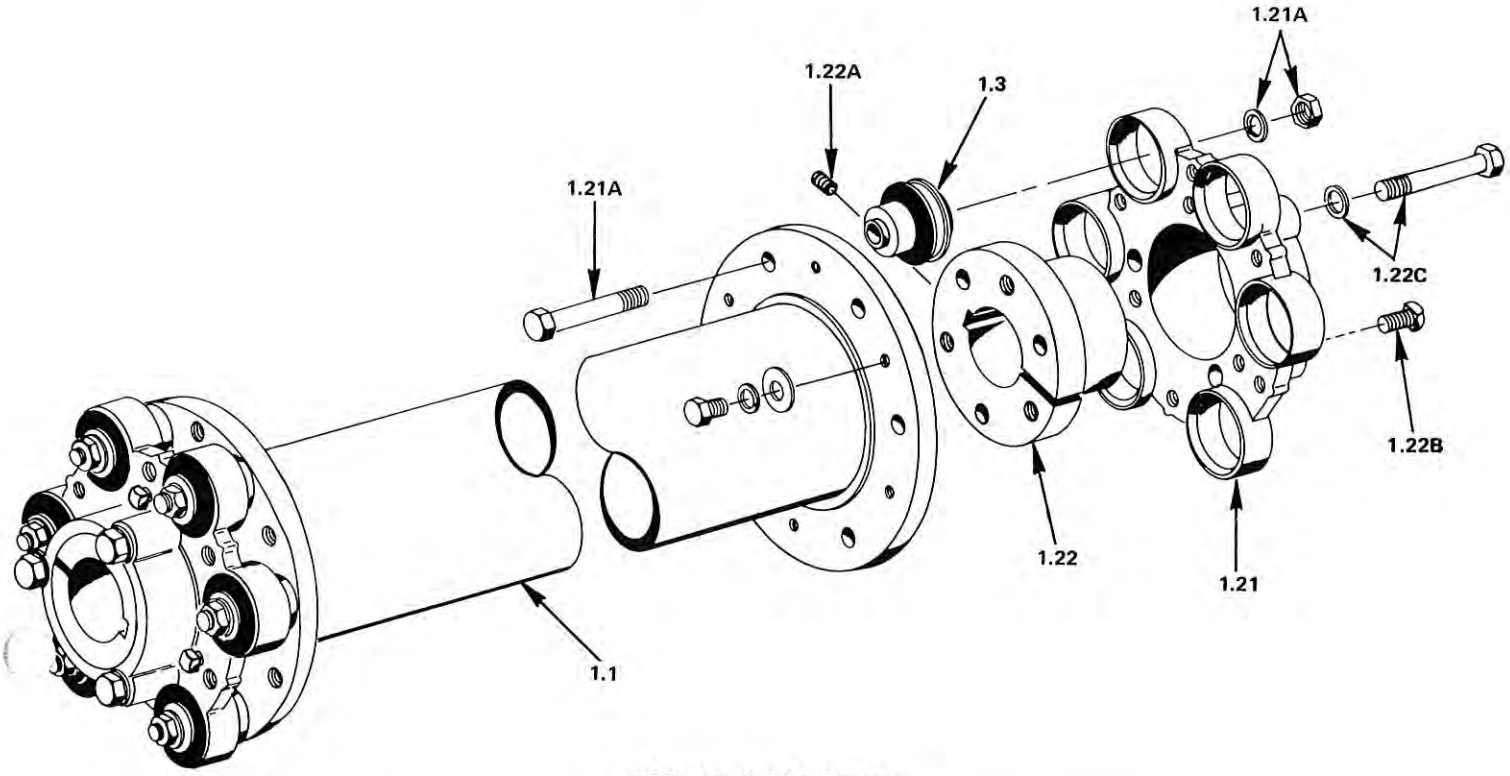
REPLACING BONDED RUBBER BUSHINGS

1. Locate match marks on yokes and tube flanges. If not identifiable, put new match marks on edge of flanges. Remove tube and flange assembly by removing the six machine bolts at each end of the drive shaft. It may be necessary to loosen one of the yokes and slide it back on the shaft.
2. Remove tapered bushings and yokes from their respective shafts.
3. Remove existing rubber bushings by pressing or pulling them out of the sockets.
4. Clean sockets but do not polish.
5. Lubricate bushing with soapy water or rubber lubricant before inserting in the sockets. The bushings are an interference fit.
6. Using a C-clamp, press the bushing (pilot end first) into the socket from the outside face until the rubber projects an equal amount from each side of the yoke flange.
7. Assemble yokes to tube and flange assembly and refer to section titled "Installation".
8. Rebalance as necessary.

MARLEY

PARTS MANUAL SHEET

SERIES 301 CLASS III DRIVE SHAFTS
All Stainless Steel



REPLACEMENT PARTS

1.0 COMPLETE DRIVE SHAFT ASSEMBLY, READY FOR INSTALLATION.

1.1 TUBE AND FLANGE ASSEMBLY.

1.2 YOKE ASSEMBLY, COMPLETE WITH SPLIT TAPERED BUSHING, CAP SCREWS, SET SCREWS, MACHINE BOLTS, LOCKWASHERS AND NUTS (GEAREDUCER OR MOTOR END).

- **1.21** YOKE (TWO REQUIRED PER DRIVESHAFT).
  - **A.** MACHINE BOLTS WITH LOCKWASHERS AND NUTS (SIX REQUIRED PER YOKE).
- **1.22** BUSHING, SPLIT TAPERED (GEAREDUCER OR MOTOR END).
  - **A.** SET SCREW (ONE REQUIRED PER BUSHING).
  - **B.** SET SCREWS (THREE REQUIRED PER BUSHING).
  - **C.** CAP SCREWS WITH LOCKWASHERS, (THREE REQUIRED PER BUSHING).

1.3 BONDED RUBBER BUSHINGS, (TWELVE REQUIRED FOR EACH COMPLETE DRIVE SHAFT ASSEMBLY).

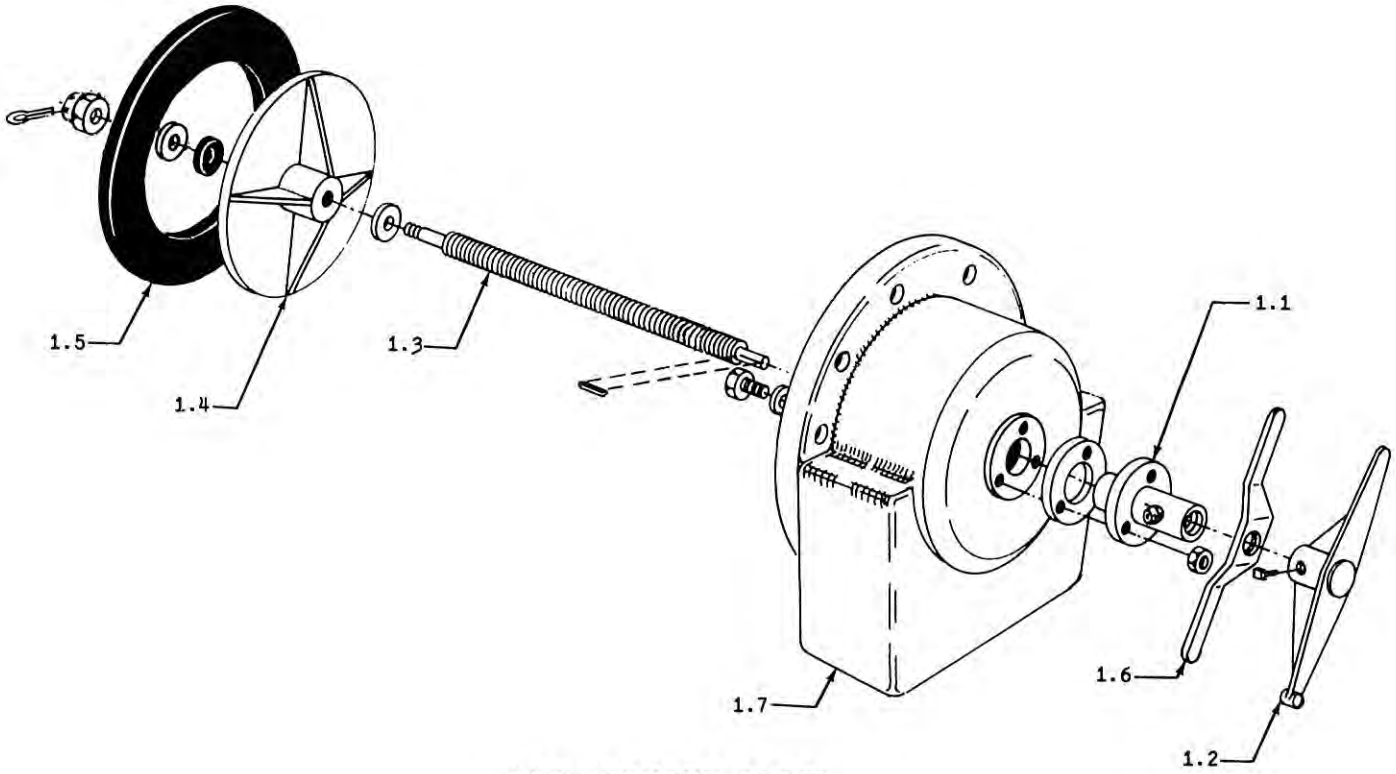
NOTE: Complete drive shaft assemblies are dynamically balanced at the factory. When replacement parts are installed, drive shaft must be re-balanced. Refer to Series 301 Service Manual.

When ordering parts always provide original Marley order number and tower serial number. Contact the Marley sales office or representative in your area for assistance.

PARTS MANUAL SHEET

HORIZONTAL FLOW CONTROL VALVES

10", 12", 14", 16", 18" AND 20" DIAMETERS



REPLACEMENT PARTS

ITEM 1.0 COMPLETE VALVE ASSEMBLY, ready for installation.
ITEM 1.1 VALVE STEM GUIDE INCLUDING GASKET, GREASE FITTING AND ATTACHING HARDWARE.
ITEM 1.2 OPERATING BAR WITH SET SCREW.
ITEM 1.3 VALVE STEM INCLUDING KEY, WASHERS, RESILIENT WASHER, CASTLE NUT AND COTTER PIN.
ITEM 1.4 VALVE DISC
ITEM 1.5 VALVE BODY GASKET
ITEM 1.6 LOCKING BAR
ITEM 1.7 VALVE BODY

When ordering parts always provide original Marley order number and tower serial number. Contact the Marley sales office or representative in your area for assistance.

ASSEMBLY SEQUENCE

1. ATTACH VALVE STEM GUIDE AND GASKET TO VALVE BODY.
2. PLACE DISC AND WASHERS ON STEM. INSTALL CASTLE NUT AND TIGHTEN TO COMPRESS RESILIENT WASHER TO 1/8 TO 3/16 THICK. INSTALL COTTER PIN.
3. INSTALL STEM AND DISC ASSEMBLY THROUGH VALVE STEM GUIDE AND BODY. CENTER DISC IN VALVE INLET OPENING BY DIFFERENTIAL TIGHTENING OF THE THREE STEM GUIDE BOLTS.
4. INSTALL LOCKING BAR.
5. INSTALL OPERATING BAR ON STEM AND INSERT KEY. TIGHTEN SET SCREW AGAINST KEY.
6. LUBRICATE STEM GUIDE WITH LITHIUM BASE GREASE.

MARLEY

Installation, Operation and Maintenance of ELECTRIC MOTORS on Cooling Towers and DriCoolers

RECEIVING MOTORS

Motor should be inspected on receipt to make sure it was not damaged during shipment. Turn the shaft by hand to see that it turns freely. Check motor name plate for correct voltage, phase and speed.

If two speed motors are provided, be sure control characteristics are compatible with motor. A two speed single winding motor requires a different starter than a two speed two winding motor. Starters for two speed motors must include a minimum time delay of 20 seconds when switching from high to low speed.

If reverse operation of mechanical equipment is required, provide minimum time delay of two minutes before energizing motor when changing direction of rotation.

STORING MOTORS

If a motor is stored before installation, place it in a building in which air is kept reasonably dry and with a minimum of temperature fluctuation to prevent moisture condensing in the motor. Do not store directly on the floor, always block up.

If outdoor storage is necessary, protection should include a vapor barrier beneath the motor. The motor should be blocked up to prevent flooding.

Rotate motor shaft monthly to insure that the bearing surfaces are protected with lubricant.

INSTALLATION

NOTE: After motor is installed, it should be run for three hours at least once a month, even if the tower is not in operation. This serves to dry out windings and relubricate bearing surfaces. If motors are purchased with space heaters, they should be energized as soon as possible. Use an auxiliary contact on the starter to turn heater off when motor is running.

The power supply line for the motor should be of sufficient capacity to carry 125 percent of the motor's full load current with a maximum voltage drop of three percent on the line.

Wire the motor to the power supply through a disconnect switch, short-circuit protection, and suitable magnetic starter with overload protection. All wiring and fusing should be in accordance with the National Electrical Code and local requirements. All motors should be connected as shown on the name plate diagram.

The National Electrical Code requires a motor to be in sight of the controller unless the disconnecting means can be locked open or unless there is a manually operated switch in sight of the motor which will disconnect the motor from its electrical supply.

Two-speed or part-winding-start single speed motors require a 6-pole disconnect or two 3-pole disconnects with handles mechanically locked together when installed between the motor and starter.

The conduit system should be arranged so that trapped water will collect in a sump equipped with suitable drain and will not go into the motor terminal box.

When the motor must be moved for coupling removal or belt adjustment, a short section of flexible, water-tight metallic conduit should be used in place of rigid conduit to protect the leads to the motor.

Remove all water drain plugs on Totally Enclosed motors.

These plugs will be located in the lowest part of the installed motor. The drain plugs on Explosion Proof motors are automatic and must not be removed. Sometimes plugs must be removed before the motor is bolted in place.

Check to see that the name plate data agrees with the voltage and frequency of the power supply provided for the motor. All induction motors will operate successfully when the frequency is not more than five percent above or below the rating, the voltage is not more than ten percent above or below the rating, and the combined variation in voltage and frequency is not more than ten percent above or below the rating.

Power supply must conform with motor nameplate voltage. Motors rated 200 volts are for a 208 volt system. Motors rated 230/460 volts are for a 240 or 480 volt system. Do not use a 230 or 230/460 volt motor on a 208 volt system.

Where motor power is supplied by overhead conductors, it is advisable to provide a lightning arrestor on each ungrounded line.

Unbalanced voltages in the power supply will greatly increase the internal losses of the motor, reducing the safe load the motor can carry. Have the power company correct any unbalanced voltage.

Overload protection should be installed in all three lines. Size overload heaters in starters for name plate service factor and amps. Overloads for 1.15 service factor motors must kick out at no more than 125% of name plate current. Overloads for 1.0 service factor motors must kick out at no more than 115% of name plate current.

Overloads should be at the same ambient temperature as motor. Do not use ambient compensated overloads.

Check the wiring system for grounds and check the resistance between all leads for open, bad or incorrect connections before operating the motor.

OPERATION

Sleeve bearing motors are usually shipped without oil and *must be oiled before operating*. Ball bearing motors are lubricated for the initial operation by the manufacturer. Turn the rotor by hand to see that it rotates freely. Motor shaft should be parallel to driven shaft so that there are no stresses in frame. Belt tension should be reasonably tight, not binding.

Do not cycle a motor on and off more than necessary. Too frequent cycling may cause the windings to burn out. Generally, the total of the starting times should not exceed 30 seconds each hour. For example, a motor which requires 5 seconds to come up to speed would accumulate 30 seconds total starting time in six starts.

INITIAL STARTING: Motor should bring fan up to speed in less than 15 seconds. If it does not, check connections, fuses, overloads and voltage at motor terminals during start-up period. Run the motor to check the connections and direction of rotation. To change direction of rotation of three-phase motors, interchange any two line leads.

DETERMINE FAN LOAD. After all duct work is installed and unit is ready for operation with rated water and heat on the tower, check the fan load as follows:

1. Run motor for 30 minutes. Record motor name plate date.
2. Measure voltage between all lines at motor terminals.
3. Measure amps in all three lines.
4. Average the measured volts and amps and calculate test horsepower using the following equation:

$$HP\ (test) = \frac{Volts \times Amps\ (average)}{Volts \times Amps\ (name\ plate)} \times HP\ (nameplate)$$

5. For a given pitch setting and RPM, fan horsepower will vary directly with the air density which is a function of temperature and barometric pressure. Because fans are generally pitched for summer weather horsepower, it is expected that the motor name plate horsepower will be exceeded during winter operation. Although the temperature rise in the motor will be greater at the higher horsepower, the operating temperature of the motor will actually be lower due to the drop in ambient temperature. Under these conditions, the higher horsepower should not be detrimental to the motor.

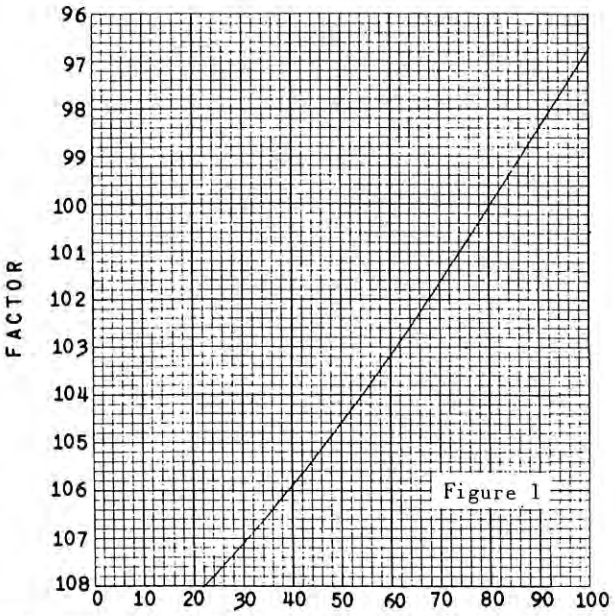
   If the horsepower measurement is taken during cold weather conditions, the predicted horsepower which will result during summer operation may be determined by applying the Factors from Figure 1. For a given location, the barometric pressure will not normally vary enough to cause significant error and for this reason, has not been included in the Factors.

   Example: The fan load horsepower on an induced draft cooling tower* is 7.8 HP on a 40^{o} ambient wet-bulb day. What is the predicted HP on a 75^{o} ambient wet-bulb day?

$$HP_{(75^{o}F)} = HP_{(40^{o}F)} \times \frac{Factor\ (75^{o}F)}{Factor\ (40^{o}F)} = 7.8 \times \frac{100.8}{105.9} = 7.43$$

   If it is desired to correct for high or low test barometric pressure, multiply the predicted horsepower by standard station barometric pressure and divide by test station barometric pressure.

   *Use ambient dry-bulb temperatures if checking a forced draft DriCooler or cooling tower.



Induced Draft Cooling Tower – Ambient WB – °F.

Forced Draft DriCooler – Ambient DB – °F.

Fan motor overloads sized for summer weather will handle the higher winter horsepower without adjustment providing they are at the same ambient temperature as the motor.

NORMAL OPERATION. Class B insulated motors are rated at a maximum total operating temperature of 130°C (266°F). A thermometer in contact with the winding may indicate a temperature up to 100°C (212°F) on a protected motor or up to 115°C (239°F) on a totally enclosed motor without the motor being too hot. Therefore, if a motor feels hot to a person's hand, it is not necessarily overloaded. Check with thermometers.

SEASONAL SHUTDOWN. If a motor is used only seasonally, it should be cleaned and lubricated at the close of each season. Remove V-belts at the close of each season, (see Service Manual "Care of V-Belts and Sheaves"). *Motor should be run for three hours at least once a month, even if tower is not in operation.*

MAINTENANCE

SAFETY NOTE: *When working on the fan or fan drive make sure the electric motor cannot be started, see "Installation" section.*

To obtain maximum motor life, the user should establish a schedule of maintenance based on his particular application and observe the following procedures and precautions.

CLEANING: Remove any oil, dust or deposits on the motor. They can cause excessive insulation temperatures.

LUBRICATION:

BALL BEARINGS: The following table may be used as a guide in determining greasing periods for motors:

DUTY	1 – 30 HP	40 – 250 HP
Intermittent	12 mo.	12 mo.
8 to 16 hours per day	12 mo.	6 mo.
Continuous	8 mo.	4 mo.

All greases will deteriorate in time depending upon bearing size, speed and temperature. The grease used should be recommended by the motor manufacturer. In general, a polyurea or lithium base grease with rust and oxidation inhibitors is recommended. A No. 2 consistency grease is best for horizontal applications. It is not advisable to mix greases which are of different types or specifications. If a change is desired, the bearing housing should be completely cleaned.

The relief method of greasing motors tends to purge the bearing housing of used grease by forcing out old grease with new grease. Use a plunger type grease gun which will not fit the bearing fill hole too tightly.

Either an excess or insufficient amount of lubricant in the bearings can cause over-heating. To prevent this occurrence, use the following greasing procedure:

1. Stop motor.
2. Wipe grease plug, bearing housing and relief plug clean.
3. Remove grease and relief plugs and free relief hole of any hardened grease. Use wire in opening.
4. Add grease with a hand operated pressure gun until new grease appears at the relief hole. Take special care when greasing the fan end bearing of TEFC motors. The long relief might be too small for the bearing to relieve properly.
5. Run the motor for approximately one hour after greasing to permit rotating parts of the bearing to expel excess grease. Take out some of the excess grease with a wire.
6. Replace plugs and wipe the outside housing clean.

Every few years, motor end brackets should be removed and grease reservoirs cleaned and repacked full with approved ball bearing grease. Open bearings should be cleaned and repacked.

Bearings should be checked for "roughness" by turning the outer race slowly with the fingers while holding the inner race. If the bearing feels rough or binds in spots, it should be discarded.

SLEEVE BEARINGS: Check oil in sleeve bearings at least every three months. When journal size is less than two inches, stop the motor to check the oil level. Old oil should be drained and replaced at least every year. Clean out oil well if there is evidence of dirt and sludge.

Motor shaft must be stopped when motor is oiled. The oil used should be a good grade of mineral oil of light or medium viscosity (such as SAE No. 10). Turbine oil rather than automotive crankcase oil is recommended.

Check bearing wear yearly by measuring the air gap with a feeler gauge. Measure gap in at least four equally spaced positions at each end of the motor with two of the places being the lowest point and the point subject to the load pull.

INSULATION: Check insulation resistance with a megohmmeter at the end of each shutdown period. When resistance is less than the value as calculated by

$$\text{Megohms} = \frac{1000 + \text{Rated Voltage of Machine}}{1000}$$

the motor must be dries out before starting.

Motors in continuous operation will stay at a temperature sufficiently above ambient temperature to prevent condensation of moisture on and about the windings, even if the location is very humid. Idle motors, however, accumulate moisture readily which causes gradual deterioration of insulation. Where motors are idle for a long time, single-phase heating or space heaters may be required to prevent water condensation.

Check insulation resistance at least once a year with the machine at normal working temperature. Comparison with several previous readings will give an indication of improvement or deterioration of insulating value. Readings, to have comparison value, should be taken under the same conditions (temperature, operating time since last shutdown, etc.).

Low or falling resistance readings indicate the need for maintenance. Contact the nearest service shop of the motor manufacturer.

VIBRATION: If vibration occurs, it should be corrected without delay. Use the following procedure to determine source of trouble:

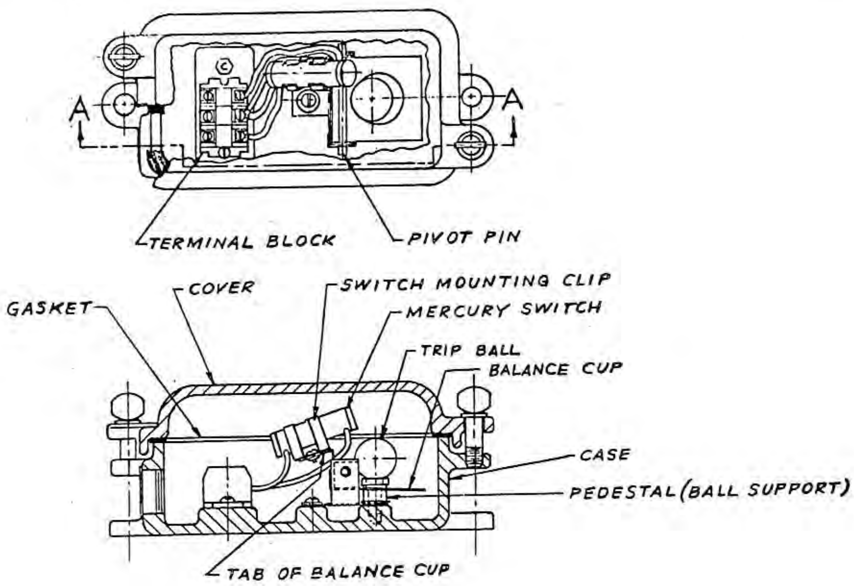
1. Check motor mounting to see that fasteners are tight.
2. Disconnect motor from load and run motor separately.
3. If vibration is in mechanical equipment, check:
   a. Alignment of motor with mechanical equipment.
   b. Belts, bearing housing or Geareducer.
   c. Unbalance in drive shaft or fan.

MOTOR WARRANTY

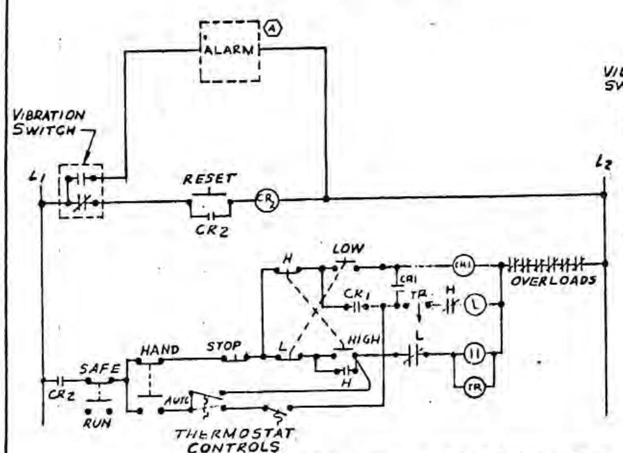
The motor warranty is usually worded so that the motor manufacturer warrants that the equipment will be of the type and quality described, suitable for the duty for which it was furnished and free of defects in materials and workmanship. Therefore, if a motor fails for some other reason (i.e., power supply causing the motor to single-phase) the motor manufacturer is not liable.

The warranty extends for one year from date of installation. If any failure to comply with the warranty appears within the year and purchaser promptly notifies motor manufacturer, the manufacturer shall be liable and shall have the right to remedy any such failure by adjustment, repair or replacement, F.O.B. factory, of any defective parts. The motor should not be sent to a repair shop without the manufacturers permission or the manufacturers warranty will be void.

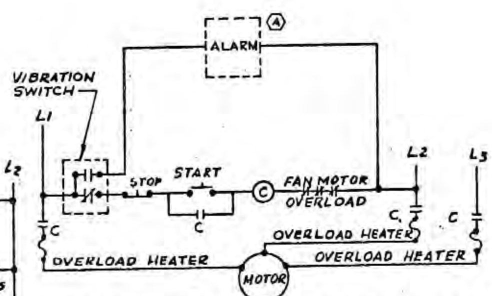
The motor manufacturer's warranty does not cover the cost of dismounting, shipping to and from repair shop or remounting of the motor.



SECTION A-A



TYPICAL WIRING DIAGRAM FOR 2 SPEED MOTOR, MANUAL AND AUTOMATIC CONTROLS, SHOWING VIBRATION SWITCH LOCATION (B)



TYP. WIRING DIAGRAM OF FAN MOTOR, MANUAL CONTROL, SHOWING VIBRATION SWITCH LOCATION (B)

I. DESCRIPTION:

THIS VIBRATION LIMIT SWITCH IS WIRED TO INTERRUPT POWER TO THE HOLDING COIL (S) OF THE MAGNETIC STARTER AND TO SUPPLY POWER TO AN ALARM CIRCUIT, THUS STOPPING THE MOTOR AND ENERGIZING AN ALARM WHEN EXCESSIVE VIBRATION OCCURS. THE SWITCH IS EQUIPPED WITH A SINGLE POLE, DOUBLE THROW HYDROGEN ARC-QUENCHED MERCURY SWITCH. THE SWITCH, AS FURNISHED, IS WIRED WITH THE MOTOR CIRCUIT NORMALLY CLOSED AND THE ALARM CIRCUIT NORMALLY OPEN.

II. INSTALLATION:

A. SWITCH MUST BE LEVEL AND FASTENED SECURELY TO SUPPORT
B. CONNECTION OF CONDUIT TO SWITCH MUST BE WATERTIGHT.
C. AFTER WIRING, TRIP SWITCH MANUALLY TO CHECK CIRCUIT INTERRUPTION.

III. RESETTING THE SWITCH:

A. SHUT OFF MOTOR.
B. DETERMINE WHY THE SWITCH TRIPPED AND CORRECT THE CAUSE. SOME CAUSES OF EXCESSIVE VIBRATION MAY BE: BENT OR UNBALANCED DRIVE SHAFT, LOOSE MOUNTING BOLTS, UNBALANCE OF FAN DUE TO DEPOSIT ON BLADES, AND MOTOR START UP OR SPEED CHANGE.
C. IF SWITCH TRIPS FALSELY: WITH THE MERCURY SWITCH IN AN UNTRIPPED POSITION, TEST SENSITIVITY BY USING A TEST LIGHT AND BY TILTING THE SWITCH SLIGHTLY. IF THE TEST LIGHT GOES OUT, BEND THE TAB SUPPORTING THE SWITCH TO DECREASE SENSITIVITY TO A DESIRED LEVEL.

TEST MOVEMENT OF BALANCE CUP TO BE SURE THE SWITCH LEADS ARE NOT INTERFERRING WITH SWITCH ACTION.

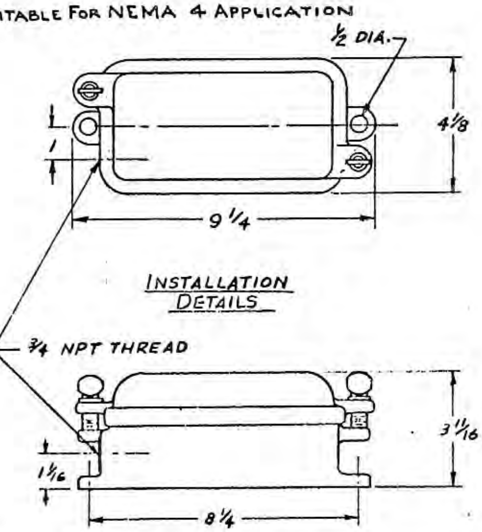
IV. ELECTRICAL RATING:

115V ----- 4 AMPS A. C. CONTINUOUS OR 4 AMPS D. C.
(C) 230V ----- 2 AMPS A. C. CONTINUOUS OR 2 AMPS D. C.
(B)(A) 440V ----- 1 AMP A. C. CONTINUOUS

(E)(A) RATED 600 VOLTS DIELECTRICALLY
THE TERMINAL BLOCK IS RATED IN EXCESS OF 600 VOLTS.
THE MAXIMUM WIRE SIZE IS #8.

NOTE: REFER TO MARLEY TECHNICAL BULLETIN TS-63-E-1C FOR OTHER DETAILS OF CONTROL CIRCUITS.

V. SUITABLE FOR NEMA 4 APPLICATION



FABRICATION TOLERANCE
UNLESS OTHERWISE NOTED

COMMON FRACTIONS MAY VARY	+ or − 1/16"
XX.XX DECIMALS MAY VARY	+ or − .030"
XX.XXX DECIMALS MAY VARY	+ or − .010"
BREAK SHARP CORNERS .04"	+ or − .030"
MACHINE FILLET RADII .04R	+ or − .030"
CAST CORNER R TO BE	1/8"
CAST FILLET R TO BE	
ANGLES MAY VARY	+ or − 1/2°

(A) THIS DWG. APPLIES ONLY TO ASSY. NO. 67-3509-1

LTR.	DATE	REVISIONS	BY	CHECKED	B.M.
F	6-14-73	DELETE REV. 'D'	HCB	P.O.	
E	4-18-72	ERR 72-233	HCB	AHB	
D	2-6-69	ADDED NOTE	JWF	JLT	
C	1-9-69		LRD	JWF	
B	7-14-67	ADDED 440V. RATING, 600V DIELEC. RATING WAS 300V. REVISED DIAGRAMS TO CONFORM TO ELEC. STDS.	JWF	LRD	
A	4-13-67	300V. WAS 600V. REMOVED 440V ELEC. RATING; ADDED NOTE	JWF		

MASTER FILE | FOREIGN FILE

GENERAL DETAILS OF SPECIAL SPDT M-1 VIBRATION LIMIT SWITCH

THE MARLEY COMPANY
KANSAS CITY, MISSOURI

SCALE	DATE	DRAWN	CHECKED	APPROVED
NONE	3-24-67	JWF		

.00# Drawing No. 67-3510 Rev. F

Drawing No. 67-3510

COOLING TOWER INSPECTION TIPS

These Inspection Tips, used in conjunction with the Cooling Tower Inspection Check List, are offered as a guide in developing a comprehensive plan for inspection of any Cooling Tower.

Numbers in the text of these inspection tips correspond to items in the Inspection Check List. Show type or size in parentheses adjacent to items in the check list. Check each item as "good", "repair", or "replace" in appropriate column.

Upon completion of the Inspection Check List, the original (white) and duplicate (yellow) copies can be forwarded to appropriate personnel for purchase of required items or services, or scheduling of routine maintenance work. The hard copy can be retained as a record of the inspection and a record of replacement parts purchased and maintenance accomplished.

INSPECTION TIPS

EXTERIOR STRUCTURE:

The inspection of the exterior of the cooling tower is largely a visual examination of the components described.

1. Endwall Casing and Access Doors: If flat or corrugated asbestos cement board, or glass reinforced polyester casing, look for leaks, cracks, loose attaching hardware, or other damage. If wood casing, look for evidence of wood decay. Check access door hinges and latches and general condition of such doors.

2. Louvers: Look for splits or breakage of wood louvers. Check for out of position louvers. Examine louver supports for adequate attachment. Check for wood decay in louver supports. Look for broken or cracked asbestos cement or glass reinforced polyester louvers. Look for ice damage to louver supports.

3. Drainboards: Look for damaged or displaced drain boards. Check for any evidence of water being diverted outside drainboards rather than inside.

4. Stairway: Stair treads and stringers should be checked for any cracks or breakage and for evidence of looseness. Check for loose or deteriorated stairway handrails and kneerails.

5. Fan Deck:
6. Fan Deck Supports:
7. Handrails:
8. Ladders and Walkways:
18. Walkways:

Examine fan deck and fan deck supports for decay or loose or broken members. Check handrails and kneerails for looseness or damage. Check ladders and walkways for loose or damaged rungs and treads or deterioration of stringers and rails.

9. Distribution System:
10. Spray System:

Inspect headers for decay, rust, or acid attack. Check pipe bands and flange connections for tightness and condition. Look for deterioration in distribution basins or piping. Check for warpage or splitting boards in basin sides or wood piping. Operate flow control valves full travel and check for lubrication of the valve stems. Check to be sure all nozzles are in place and clean.

11. Fan Cylinders: Check fan cylinders for adequate blade tip clearance. Look for damage, deterioration, or looseness of fan cylinders. Be sure fan cylinders are securely anchored.

INTERIOR STRUCTURE:

12. Fill: The tower fill should be inspected for any deterioration, breakage, or misplaced splash bars. Check condition of splash bar supports. Look for damage to the fill supports or splash bars.

13. Columns:
14. Girts: Tower columns, girts, and diagonals should be "sounded" by striking them with a hammer. The sound of the wood being struck will indicate the condition. A dull,

15. Diagonals: low-key sound indicates softness of the wood, while a higher pitch, sharper sound indicates good wood. If softness (wood rot) is suspected, probing with an ice pick, screwdriver, or similar sharp instrument will provide further information on the wood condition. Avoid probing treated wood. Check particularly around steel or cast iron fasteners for deterioration of the wood in contact with iron. Inspect bolt condition and check for tightness.

16. Partitions and Doors: Check for loose or deteriorated partition boards. Inspect nails and bolts in partitions for corrosion and looseness.

17. Eliminators: Inspect eliminators for displaced, deteriorated, or broken eliminator blades or supports. Check for clogging from debris, algae, or slime.

19. Cold Water Basin: Inspect concrete cold water basins for cracks, open joints, flaking of concrete, or acid attack. If wood or metal basins are used, check for deterioration, open joints, or warped or split basin sides.

20. Mechanical Equipment Supports: Inspect mechanical equipment supports for corrosion, loose anchor bolts, deterioration of wood structural members in contact with steel supports, or any evidence of loss of structural strength.

MECHANICAL EQUIPMENT:

21. Drive Shafts: Check drive shaft couplings for corrosion or wear. Check drive shaft floating center member (tube and flange assembly) for corrosion by "sounding" (light blow with small hammer) the tube along its length for "dead" spots which can indicate internal corrosion. Inspect drive shaft keys and set screws. Check assembly hardware for tightness.

22. Speed Reducers: Check speed reducers for proper oil level and check oil for moisture and sludge. Check gear back-lash by rotating the input shaft by hand back and forth against the gear tooth contact. Check pinion (input shaft) bearings for wear by attempting to move the shaft radially. Check fan shaft bearings for excessive end play by applying force up and down on a fan blade tip and note movement (by feel) of the output shaft. A running clearance is built into some output shafts and must not be confused with excessive end play.

23. Fans Inspect fan hubs for corrosion and erosion. Check hub covers for corrosion and for condition of attaching hardware. Check blade clamping arrangement for corrosion and tightness. Inspect fan blades for corrosion and erosion. Check blades for build-up of solids such as to change the blade moment weight or air foil characteristic. Check fan blade pitch. All blades should be uniformly pitched.

Other tower components should be checked for proper function, such as vibration cut out switches. Check for corrosion or looseness of anchor bolts.

Check oil gage and drain lines for agreement of oil level in Geareducers with oil level at external sight glass or dip stick. Check for leakage.

24. Motors: Check motor bearings for any excessive heating. Check for proper lubrication of bearings. (Note: Excessive lubrication of ball bearing motors can damage bearings or force grease into windings and cause deterioration of insulation). Lubricate motor bearings in accordance with motor manufacturers recommendations. Check for deposits of dirt or dust at motor air intakes. Check TEFC motors for condition of fans and air passages. Check operating loads (amperes and volts) as compared with name plate data. Clean and paint motor exterior as required.

Complete the Cooling Tower Inspection Check list during this inspection. Note in the appropriate section materials or components to be purchased. Show any maintenance work required, such as "change oil in speed reducers", "clean and recoat steel components", "replace fill", "treat tower for fungal attack", "replace drive shaft in cell no. 2", etc.

Forward the white and yellow copies of the completed inspection report to appropriate personnel for action. Retain the "hard" copy for record of the inspection and for a record of replacement parts purchased and maintenance accomplished as the work is done.

Marley COOLING TOWER INSPECTION CHECK LIST

Date Inspected _____ Inspected by _____ Report Written _____

Owner _____ Location _____

Plant _____ Owner's Tower Designation _____

Tower Mfr. _____ Order # _____ Model # _____ Serial # _____

Tower Serves _____ Operation: _____

Design Conditions: BHp _____, GPM _____, HW _____°F, CW _____ °F, WB _____°F

Condition: 1-Good; 2-Repair; 3-Replace	*1*	*2*	*3*
EXTERIOR STRUCTURE:			
1. Endwall Casing & Access Doors			
2. Louvers ____ (_____)			
3. Drain Boards			
4. Stairway			
5. Fan Deck			
6. Fan Deck Supports			
7. Handrails			
8. Ladders & Walkways			
9. Distribution System			
Headers (Type _____)			
Distribution Basin			
Water Level			
Flow Control Valves (Size _____)			
Nozzles (Size _____)			
Water Distribution			
10. Spray System & Spray Nozzles			
11. Fan Cylinders (Type _____)			
INTERIOR STRUCTURE:			
12. Fill (Type _____)			
13. Columns			
14. Girts			
15. Diagonals			
16. Partitions & Doors			
17. Eliminators (Type _____)			
18. Walkway			
19. Cold Water Basin (Type _____)			
Water Depth			
20. Mech. Equip. Support (Type _____)			

Condition: 1-Good; 2-Repair; 3-Replace	*1*	*2*	*3*
MECHANICAL EQUIPMENT:			
21. Drive Shafts (Type _____)			
22. Geareducers			
Series _____ Ratio _____			
Oil Level			
Oil Seals			
Vent			
Back Lash			
Pinion Shaft Play			
Fan Shaft End Play			
Last Oil Change (Date _____)			
Oil Used			
23. Fans			
Dia. _____ Type _____			
Hub			
Blades			
Hub Cover			
Tip Clearance			
No Vibration _____ Vibration _____			
Additional Components (If installed on tower)			
Fan Guards			
Oil Gauge & Drain Lines			
Vibration Limit Switches			
Other:			

Motors: Mfr. _____ Name Plate Hp _____ RPM _____ Amps _____ Frame _____ Type _____

Phase _____ Cycle _____ Volts _____ Bearing Grease Interval _____ Operating Volts _____

Operating Amps _____ Is Voltage Balanced? _____ Fluctuating? _____

Type of Motor Failure (If Any): Bearings _____ Windings _____ Shaft Seal _____ Other _____

Explanation of Recommended Replacement or Repairs: _____

SE-C1C

MARLEY

COOLING TOWER INSPECTION CHECK LIST

DUPLICATE

Route to:

Owner _____ Date Inspected _____

Plant _____ Inspected By _____

Location _____ Tower Manufacturer _____

Owner Designation _____ Installed _____ 19 _____

Water Treatment Used _____ Model No. _____

Design Conditions _____ GPM _____ HW _____ CW _____ WB

Condition: 1 - Good; 2 - Repair; 3 - Replace	1	2	3
EXTERIOR STRUCTURE:			
1. Endwall Casing & Access Doors			
2. Louvers ( )			
3. Drain Boards			
4. Stairway			
5. Fan Deck			
6. Fan Deck Supports			
7. Handrails			
8. Ladders & Walkways			
9. Distribution System			
Headers (Type)			
Distribution Basin			
Water Level			
Flow Control Valves (Size)			
Nozzles (Size)			
Water Distribution			
10. Spray System & Spray Nozzles			
11. Fan Cylinders (Type)			
INTERIOR STRUCTURE:			
12. Fill (Type)			
13. Columns			
14. Girts			
15. Diagonals			
16. Partitions & Doors			
17. Eliminators (Type)			
18. Walkway			
19. Cold Water Basin (Type)			
Water Depth			
20. Mech. Equip. Support (Type)			

Condition: 1 - Good; 2 - Repair; 3 - Replace	1	2	3
MECHANICAL EQUIPMENT			
21. Drive Shafts (Type)			
22. Speed Reducer			
Series _____ Ratio _____			
Oil Level			
Oil Seals			
Vent			
Back Lash			
Pinion Shaft Play			
Fan Shaft End Play			
Last Oil Change (Date)			
Oil Used			
23. Fans			
Dia. _____ Type _____			
Hub			
Blades			
Hub Cover			
Tip Clearance			
No Vibration _____ Vibration _____			
Additional Components (If installed on tower)			
Fan Guards			
Oil Gauge & Drain Lines			
Vibration Limit Switches			
Other:			
24. Motor: Mfr.			
Name Plate _____ HP _____ RMP			
Phase _____ Cycle _____ Volts _____			
Amperes _____ Frame _____			

REPLACEMENT PARTS REQUIRED:

QUANTITY	DESCRIPTION	ORDER FROM	DATE REQ'D

MAINTENANCE WORK REQUIRED:

DESCRIPTION	REQ'D COMPLETION

(Use back of this sheet for additional requirements or notes.)

CS–2066

MARLEY

COOLING TOWER INSPECTION CHECK LIST

Retain This Copy In File

TRIPLICATE

Route to:

Owner _____ Date Inspected _____

Plant _____ Inspected By _____

Location _____ Tower Manufacturer _____

Owner Designation _____ Installed _____ 19 _____

Water Treatment Used _____ Model No. _____

Design Conditions _____ GPM _____ HW _____ CW _____ WB

Condition: 1 - Good; 2 - Repair; 3 - Replace	1	2	3
EXTERIOR STRUCTURE:			
1. Endwall Casing & Access Doors _____			
2. Louvers (_____)			
3. Drain Boards _____			
4. Stairway _____			
5. Fan Deck _____			
6. Fan Deck Supports _____			
7. Handrails _____			
8. Ladders & Walkways _____			
9. Distribution System _____			
Headers (Type _____)			
Distribution Basin _____			
Water Level _____			
Flow Control Valves (Size _____)			
Nozzles (Size _____)			
Water Distribution _____			
10. Spray System & Spray Nozzles _____			
11. Fan Cylinders (Type _____)			
INTERIOR STRUCTURE:			
12. Fill (Type _____)			
13. Columns _____			
14. Girts _____			
15. Diagonals _____			
16. Partitions & Doors _____			
17. Eliminators (Type _____)			
18. Walkway _____			
19. Cold Water Basin (Type _____)			
Water Depth _____			
20. Mech. Equip. Support (Type _____)			

Condition: 1 - Good; 2 - Repair; 3 - Replace	1	2	3
MECHANICAL EQUIPMENT			
21. Drive Shafts (Type _____)			
22. Speed Reducer			
Series _____ Ratio _____			
Oil Level _____			
Oil Seals _____			
Vent _____			
Back Lash _____			
Pinion Shaft Play _____			
Fan Shaft End Play _____			
Last Oil Change (Date _____)			
Oil Used _____			
23. Fans			
Dia. _____ Type _____			
Hub _____			
Blades _____			
Hub Cover _____			
Tip Clearance _____			
No Vibration _____ Vibration _____			
Additional Components (If installed on tower)			
Fan Guards _____			
Oil Gauge & Drain Lines _____			
Vibration Limit Switches _____			
Other: _____			
_____			
_____			
_____			
24. Motor: Mfr. _____			
Name Plate _____ HP _____ RMP			
Phase _____ Cycle _____ Volts _____			
Amperes _____ Frame _____			

REPLACEMENT PARTS REQUIRED:

QUANTITY	DESCRIPTION	ORDER FROM	DATE REQ'D

MAINTENANCE WORK REQUIRED:

DESCRIPTION	REQ'D COMPLETION

(Use back of this sheet for additional requirements or notes.)

CS–2066

MAINTENANCE RECORD

Service Operations Performed Since Inspection of _____ 19____

GEAREDUCERS: Lubricant - Added ☐ Changed ☐ Quantity _____

_____

_____ Cell No. _____ Date _____

FANS: _____

_____

_____ Cell No. _____ Date _____

DRIVE SHAFTS: _____

_____

_____ Cell No. _____ Date _____

COUPLINGS: _____

_____

_____ Cell No. _____ Date _____

MOTORS: _____

_____

_____ Cell No. _____ Date _____

VALVES: _____

_____

_____ Cell No. _____ Date _____

DISTRIBUTION SYSTEM: _____

_____

_____ Cell No. _____ Date _____

STRUCTURE: _____

_____

_____ Cell No. _____ Date _____

COMMENTS: _____

_____

_____

_____

_____

PART III - ATTACHMENTS

Asbestos Information

PETROLEUM LABORATORIES, INC.

333 East Kaliste Saloom Road
Lafayette, Louisiana 70508
337-234-7414

109 Cleveland Street
Houma, Louisiana 70363
985-868-4820

Company: City of Houma
POWER PLANT
P.O. Box 6097
Houma, LA 70361

Date: 10/11/08 Lab No: HRJ-0023

Field: Cooling Tower

Attention: Mr. Cy LeBouef

Asbestos Analysis

Cooling Tower
Sample Rec'd. 10-01-08

Summary of Results

Sample Identification	Asbestos	Other Fibrous Material	Non-Fibrous Material
Light Gray Homogeneous Non-Friable	Present Chrysotile, 15 – 20%	None	Carbonaceous

Cooling Tower
Siding
Asbestos Report

Method: EPA 600/R-93/116, July 1993
Subcontracted to Chemtex Environmental (Port Arthur, TX).

OCT 14 2008

Attest: R L Burton

☑ 109 Cleveland Street
Houma, LA 70363
(985) 868-4820

PETROLEUM LABORATORIES, INC.

CHAIN OF CUSTODY

☐ 333 E. Kaliste Saloom Rd.
Lafayette, LA 70508
(337) 234-7414

Company: TPCG

Phone Number:

Field / Sample Point: Power Plant

☐ Regulatory ☐ Non-Regulatory

Sample Date	Sample Time	Comp	Grab	Sample Location / Identification	Matrix (W = Water SL = Sludge S = Soil O = Other)	Number of Containers	Bottle (P = Plastic G = Glass S = Sterilized V = 40 mL Vial)	Size (1 = 1 Liter 4 = 4 oz. 8 = 8 oz. 6 = 6 oz. 16 = 16 oz.)	Preservation (0 = None 1 = Hydrochloric 2 = Nitric 3 = Sulfuric 4 = Phosphoric)	Analysis Requested: Asbestos	Analysis Requested	Analysis Requested	Analysis Requested	Analysis Requested	Analysis Requested	FOR OFFICE USE ONLY: CONDITION OF SAMPLES UPON RECEIPT AT LAB — PLI LAB NUMBER	pH - s.u.	Temp - °C
				Cooling Tower / Houma	O	1	—	—	—	✓						HRJ.0023		

Sampler (s) *(Print)*

	Date:	Time:		Date:	Time:
1. Relinquished By: Ray Melerson JR			2. Received By:		
3. Relinquished By:			4. Received By:		
5 Relinquished By:			6. Received for Laboratory: Julie Tarpley	10.01.08	1311

Turn-Around Time

Normal Service
☐ 3 - 5 Days

Rush Service
☐ 24 Hrs ☐ 48 Hrs

Date Results To: Cy LeBoeuf

Invoice To:

Sample Remarks:

White = Lab Copy Yellow = Return with Lab Report Pink = Client Copy

☐
109 Cleveland Street
Houma, LA 70363
(985) 868-4820

PETROLEUM LABORATORIES, INC.

CHAIN OF CUSTODY

☐
333 E. Kaliste Saloom Rd.
Lafayette, LA 70508
(337) 234-7414

Company: TPCG

Phone Number:

Field / Sample Point: Power Plant

☐ Regulatory ☐ Non-Regulatory

Sample Date	Sample Time	Comp	Grab	Sample Location / Identification	Matrix (W = Water, SL = Sludge, S = Soil, O = Other)	Number of Containers	Bottle (P = Plastic, G = Glass, S = Sterilized, V = 40 mL. Vial)	Size (1 = 1 Liter, 4 = 4 oz., 6 = 6 oz., 8 = 8 oz., 16 = 16 oz.)	Preservation (0 = None, 1 = Hydrochloric, 2 = Nitric, 3 = Sulfuric, 4 = Phosphoric)	Analysis Requested: AS/BS/HS	Analysis Requested	Analysis Requested	Analysis Requested	Analysis Requested	Analysis Requested	FOR OFFICE USE ONLY: CONDITION OF SAMPLES UPON RECEIPT AT LAB — PLI LAB NUMBER	pH - s.u.	Temp - °C
				Cooling Tower / Houma	O	1	-	-	-	1								

Sampler (s) *(Print)*							
	1. Relinquished By: Ray Melbert Jr	Date:	Time:	2. Received By:	Date:	Time:
	3. Relinquished By:	Date:	Time:	4. Received By:	Date:	Time:
	5. Relinquished By:	Date:	Time:	6. Received for Laboratory:	Date:	Time:

Turn-Around Time

Normal Service
☐ 3 - 5 Days

Rush Service
☐ 24 Hrs ☐ 48 Hrs

Date Results To: Cy Laborde

Invoice To:

Sample Remarks:

White = Lab Copy Yellow = Return with Lab Report Pink = Client Copy

Job # RJ-3286

RJ3286

RIVER BIRCH LLC
NON-HAZARDOUS SPECIAL WASTE OR ASBESTOS MANIFEST

302113

GENERATOR, BILLING AND WASTE INFORMATION

GENERATOR NAME AND ADDRESS-*SITE LOCATION*	GENERATOR PHONE NUMBER
Houma Generating Station 1551 Barrow St Houma LA 70360	GENERATOR FAX NUMBER
BILL TO NAME AND ADDRESS PRIORITY ENVIRONMENTAL 316 N. EASTBANK ST. GONZALES LA 70737	BILL TO PHONE NUMBER 225-647-1708 BILL TO FAX NUMBER 225-647-1709

PROFILE NUMBER	EXP. DATE	VOLUME	UNIT
963887 LA		30 yd	

DESCRIPTION OF WASTE: Non-Friable - non-Regulated

DOES WASTE CONTAIN ASBESTOS? YES ☑ NO ☐

IF ASBESTOS, PLEASE CHECK ALL THAT APPLY:

REGULATED - FRIABLE ☐ REGULATED - CAT I/II – NONFRIABLE ☐

NONREGULATED - FRIABLE, BELOW THRESHOLD ☐

NONREGULATED – NONFRIABLE ☑

I hereby certify that the above named materials are not hazardous waste as defined by 40 CFR Part 261 or any applicable state law, have been fully and accurately described, classified and packaged, and are in proper condition for transportation according to application regulations; AND, if the waste is a treatment residue of a previously restricted hazardous waste subject to the Land Disposal Restrictions, I hereby certify and warrant that the waste has been treated in accordance with the requirements of 40 CFR Part 268 and is no longer a hazardous waste as defined by 40 CFR 261.

GENERATOR NAME, PRINTED OR TYPED *Check If Authorized Agent* ☐	GENERATOR SIGNATURE	DATE
Douglas J Simoneaux		10-8-2021

TRANSPORTER INFORMATION

TRANSPORTER NAME AND ADDRESS	TRANSPORTER PHONE AND FAX NUMBERS
Three G's Transporting 101 I-310 Service Rd St Rose LA 70087	(504) 712-7822 (504) 712-7831
TRANSPORTER ID NUMBER *(Issued by LDEQ)* 1-089-03570	VEHICLE LICENSE NUMBER C288298
TRANSPORTER SEWERAGE SLUDGE ID No. *(Issued by LDEQ for sewerage sludge haulers only)*	TRUCK NUMBER RZ CONTAINER NUMBER *(If hauling sewerage sludge)*

I hereby certify that the above named material was transported from the generator's facility listed above and was delivered without incident to the destination listed below.

DRIVER NAME, PRINTED OR TYPED	DRIVER SIGNATURE	DATE
James R Stuart Jr.		10.08.21

LANDFILL INFORMATION

DESTINATION FACILITY: RIVER BIRCH LANDFILL | 2000 South Kenner Road | Avondale, LA 70094

PHONE (504) 436-1288 | FAX (504) 436-7247

I certify, on behalf of the above listed facility, that the above named material has been accepted and to the best of my knowledge the foregoing is true and correct.

LANDFILL REPRESENTATIVE NAME, PRINTED	LANDFILL REPRESENTATIVE SIGNATURE	DATE
Leila Thomas		10/8/21

WHITE - LANDFILL YELLOW - LANDFILL PINK - DRIVER GOLD - MISC.

RiverBirch LLC

RIVER BIRCH LANDFILL
2000 SOUTH KENNER ROAD
AVONDALE,LA 70094

** Duplicate Ticket **

SITE	TICKET	GRID	WEIGHMASTER
20	1556012	CELL 22	INGRID

DATE IN	DATE OUT	TIME IN	TIME OUT	VEHICLE	ROLL OFF
10/08/21	10/08/21	13:15	13:42	R2-3C#S	

REFERENCE	ORIGIN
NON-FRIABL	TERREBONNE

5982
1 Priority Environmental Serv
Joe Garcia
4028 Daley Avenue
Fort Worth, TX 76180

Scale Gross Wt. 52520
Scale Tare Wt. 35360
Net Weight 17160

Charge Scale Ticket

QTY.	UNIT	DESCRIPTION	RATE	EXTENSION	FEE	TOTAL
8.58	TON	Non Friable Asbestos				

NET AMOUNT
TENDERED
CHANGE
CHECK NO.

Manifest # 302113
Ticket # JAMES STUART

SIGNATURE:_____

RIVER BIRCH LLC
NON-HAZARDOUS SPECIAL WASTE OR ASBESTOS MANIFEST

302122

RT3286

GENERATOR, BILLING AND WASTE INFORMATION

GENERATOR NAME AND ADDRESS-*SITE LOCATION* Houma generating station 1551 Barrow st Houma LA 70360	GENERATOR PHONE NUMBER GENERATOR FAX NUMBER
BILL TO NAME AND ADDRESS PRIORITY ENVIRONMENTAL 316 W. Eastbank Gonzales, LA 70737	BILL TO PHONE NUMBER 225-647-1708 BILL TO FAX NUMBER

PROFILE NUMBER	EXP. DATE	VOLUME	UNIT
963887-LA		30 yrd	

DESCRIPTION OF WASTE
Non-Friable - non Regulated

DOES WASTE CONTAIN ASBESTOS? YES ☑ NO ☐

IF ASBESTOS, PLEASE CHECK ALL THAT APPLY:
REGULATED - FRIABLE ☐ REGULATED - CAT I/II – NONFRIABLE ☐
NONREGULATED - FRIABLE, BELOW THRESHOLD ☐
NONREGULATED – NONFRIABLE ☑

I hereby certify that the above named materials are not hazardous waste as defined by 40 CFR Part 261 or any applicable state law, have been fully and accurately described, classified and packaged, and are in proper condition for transportation according to application regulations; AND, if the waste is a treatment residue of a previously restricted hazardous waste subject to the Land Disposal Restrictions, I hereby certify and warrant that the waste has been treated in accordance with the requirements of 40 CFR Part 268 and is no longer a hazardous waste as defined by 40 CFR 261.

GENERATOR NAME, PRINTED OR TYPED	GENERATOR SIGNATURE	DATE
Check If Authorized Agent ☐ Deglis Josue Simon Pardo		10-7-2021

TRANSPORTER INFORMATION

TRANSPORTER NAME AND ADDRESS THREE C's PROPERTIES, INC 141 I-310 SERVICE RD ST ROSE LA 70087	TRANSPORTER PHONE AND FAX NUMBERS (504) 722-7972 (504) 712-1831 VEHICLE LICENSE NUMBER C188298
TRANSPORTER ID NUMBER *(Issued by LDEQ)* T-089-13570	TRUCK NUMBER RZ
TRANSPORTER SEWERAGE SLUDGE ID No. *(Issued by LDEQ for sewerage sludge haulers only)*	CONTAINER NUMBER *(If hauling sewerage sludge)*

I hereby certify that the above named material was transported from the generator's facility listed above and was delivered without incident to the destination listed below.

DRIVER NAME, PRINTED OR TYPED	DRIVER SIGNATURE	DATE
JAMES R. STUART SR		10.07.21

LANDFILL INFORMATION

DESTINATION FACILITY: RIVER BIRCH LANDFILL | 2000 South Kenner Road | Avondale, LA 70094
PHONE (504) 436-1288 | FAX (504) 436-7247

I certify, on behalf of the above listed facility, that the above named material has been accepted and to the best of my knowledge the foregoing is true and correct.

LANDFILL REPRESENTATIVE NAME, PRINTED	LANDFILL REPRESENTATIVE SIGNATURE	DATE
		10/7/21

WHITE - LANDFILL YELLOW - LANDFILL PINK - DRIVER GOLD - MISC.

RiverBirch LLC

RIVER BIRCH LANDFILL
2000 SOUTH KENNER ROAD
AVONDALE, LA 70094

** Duplicate Ticket **

SITE	TICKET	GRID	WEIGHMASTER
20	1555203	CELL 22	ANGELA

DATE IN	DATE OUT	TIME IN	TIME OUT	VEHICLE	ROLL OFF
10/07/21	10/07/21	10:17	11:01	R2-3C#S	

REFERENCE	ORIGIN
NON-FRIABL	TERREBONNE

5982
1 Priority Environmental Serv
Joe Garcia
4028 Daley Avenue
Fort Worth, TX 76180

Scale Gross Wt.	45640
Scale Tare Wt.	38660
Net Weight	6980

Charge Scale Ticket

QTY.	UNIT	DESCRIPTION	RATE	EXTENSION	FEE	TOTAL
3.49	TON	Non Friable Asbestos				

NET AMOUNT
TENDERED
CHANGE
CHECK NO.

Manifest # 302122
Ticket # 00CW-015

SIGNATURE: 

RJ 3286

RIVER BIRCH LLC
NON-HAZARDOUS SPECIAL WASTE OR ASBESTOS MANIFEST

302127

GENERATOR, BILLING AND WASTE INFORMATION

GENERATOR NAME AND ADDRESS-*SITE LOCATION* Houma Generating Station 1551 Barrow St Houma LA	GENERATOR PHONE NUMBER GENERATOR FAX NUMBER
BILL TO NAME AND ADDRESS 1-PRIORITY ENVIRONMENTAL 316 W Eastbank Gonzales LA 70737	BILL TO PHONE NUMBER 225-647-1708 BILL TO FAX NUMBER

PROFILE NUMBER	EXP. DATE	VOLUME	UNIT
963887 LA		30 Yd	

DESCRIPTION OF WASTE
Non Friable - Non Regulated

DOES WASTE CONTAIN ASBESTOS? YES ☐ NO ☑

IF ASBESTOS, PLEASE CHECK ALL THAT APPLY:
REGULATED - FRIABLE ☐ REGULATED - CAT I/II – NONFRIABLE ☐
NONREGULATED - FRIABLE, BELOW THRESHOLD ☐
NONREGULATED – NONFRIABLE ☑

I hereby certify that the above named materials are not hazardous waste as defined by 40 CFR Part 261 or any applicable state law, have been fully and accurately described, classified and packaged, and are in proper condition for transportation according to application regulations; AND, if the waste is a treatment residue of a previously restricted hazardous waste subject to the Land Disposal Restrictions, I hereby certify and warrant that the waste has been treated in accordance with the requirements of 40 CFR Part 268 and is no longer a hazardous waste as defined by 40 CFR 261.

GENERATOR NAME, PRINTED OR TYPED	GENERATOR SIGNATURE	DATE
Check If Authorized Agent ☐ Richard Patton		10-6-21

TRANSPORTER INFORMATION

TRANSPORTER NAME AND ADDRESS Three C's Properties INC 141 I-310 Service Rd St Rose LA 70087	TRANSPORTER PHONE AND FAX NUMBERS (504) 712-7922 (504) 712-1831 VEHICLE LICENSE NUMBER C 288298
TRANSPORTER ID NUMBER *(Issued by LDEQ)* T-089-13570	TRUCK NUMBER R2
TRANSPORTER SEWERAGE SLUDGE ID No. *(Issued by LDEQ for sewerage sludge haulers only)*	CONTAINER NUMBER *(If hauling sewerage sludge)*

I hereby certify that the above named material was transported from the generator's facility listed above and was delivered without incident to the destination listed below.

DRIVER NAME, PRINTED OR TYPED	DRIVER SIGNATURE	DATE
James R Stuart Jr		10-04-21

LANDFILL INFORMATION

DESTINATION FACILITY: RIVER BIRCH LANDFILL | 2000 South Kenner Road | Avondale, LA 70094
PHONE (504) 436-1288 | FAX (504) 436-7247

I certify, on behalf of the above listed facility, that the above named material has been accepted and to the best of my knowledge the foregoing is true and correct.

LANDFILL REPRESENTATIVE NAME, PRINTED	LANDFILL REPRESENTATIVE SIGNATURE	DATE
Angela Dennis		10/6/21

WHITE - LANDFILL YELLOW - LANDFILL PINK - DRIVER GOLD - MISC.

RiverBirch LLC

RIVER BIRCH LANDFILL
2000 SOUTH KENNER ROAD
AVONDALE, LA 70094

** Duplicate Ticket **

SITE	TICKET	GRID	WEIGHMASTER
20	1554672	CELL 22	LEILA

DATE IN	DATE OUT	TIME IN	TIME OUT	VEHICLE	ROLL OFF
10/06/21	10/06/21	11:40	12:51	R2-3C#S	

REFERENCE	ORIGIN
NON-FRIABL	TERREBONNE

5982
1 Priority Environmental Serv
Joe Garcia
4028 Daley Avenue
Fort Worth, TX 76180

Scale Gross Wt. 48540
Scale Tare Wt. 37740
Net Weight 10800

Charge Scale Ticket

QTY.	UNIT	DESCRIPTION	RATE	EXTENSION	FEE	TOTAL
5.40	TON	Non Friable Asbestos				

NET AMOUNT
TENDERED
CHANGE
CHECK NO.

Manifest # 302127
Ticket # JAMES

RS 3286

SIGNATURE: