GOODALL

FACSIMILE TRANSMITTAL

TO:

Date: 11-2-89 Attention: Pam Smodgrass

Company:

Location: DC Fax No.:

FROM:

Good-All Electric, Inc.
3725 Canal Drive
Fort Collins, CO 80524
(303) 484-3080

Time:

Sender: Jon Olsen

Fax No.: (303) 484-8649

Total Pages Being Sent: 2 (Including Cover Sheet)

IF ALL PAGES ARE NOT RECEIVED, PLEASE CONTACT OUR OFFICE IMMEDIATELY!

MESSAGE: Page 178-A-2 How to order

Please notify Pam at Phone # 1081 upon receipt of this fax.

Jon

GOODALL

FACSIMILE TRANSMITTAL

TO:

Date: 11-6-89 Attention: Pam Swadgass

Company:

Location: DC Fax No.:

FROM:

Good-All Electric, Inc.
3725 Canal Drive
Fort Collins, CO 80524
(303) 484-3080

Time:

Sender: Jim Olsen

Fax No.: (303) 484-8649

Total Pages Being Sent: 6 (Including Cover Sheet)

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MESSAGE:

Buy 178-B-6 this to order

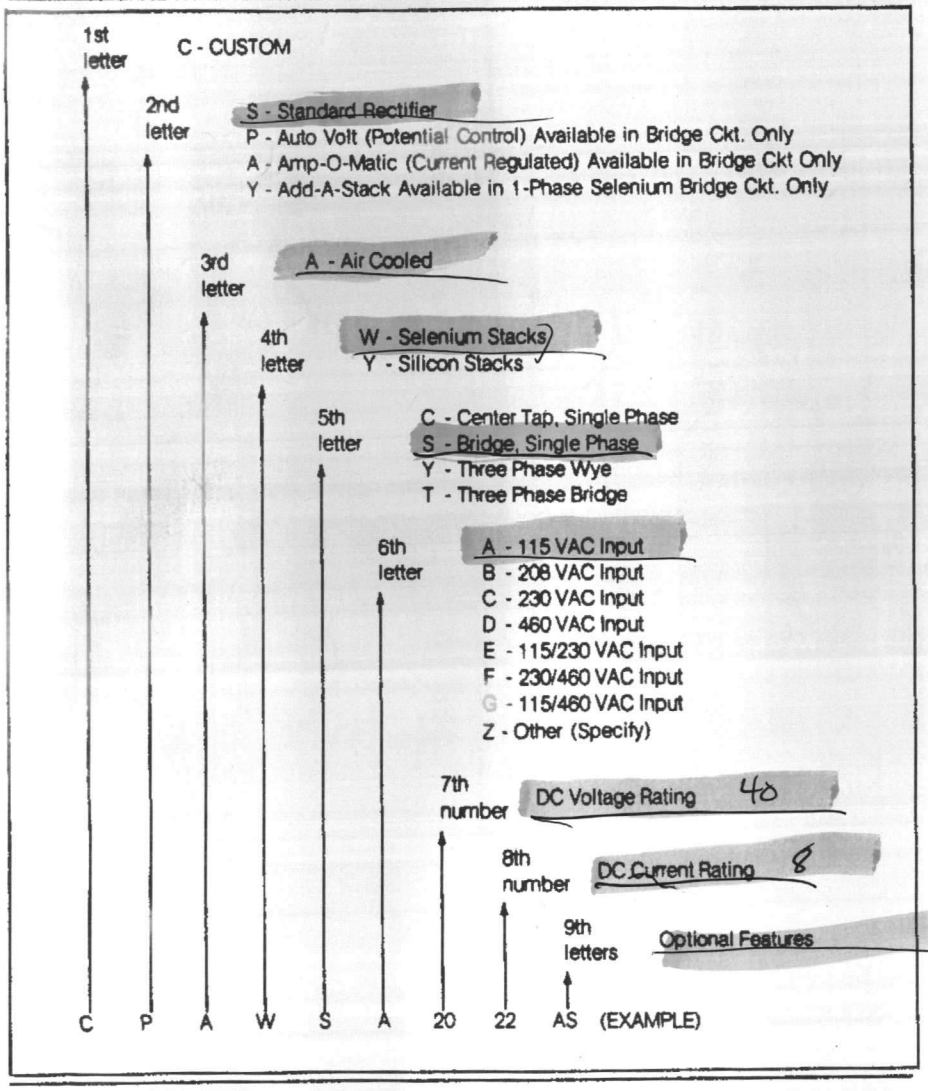
Please notify Pam at Plume # 1081 upon receipt
of this fax.

Jim

GOODALL

CUSTOM-AIR HOW TO ORDER

ORDER CODE



Rectifier P/N CFAWSA 40-8EN ordering code.

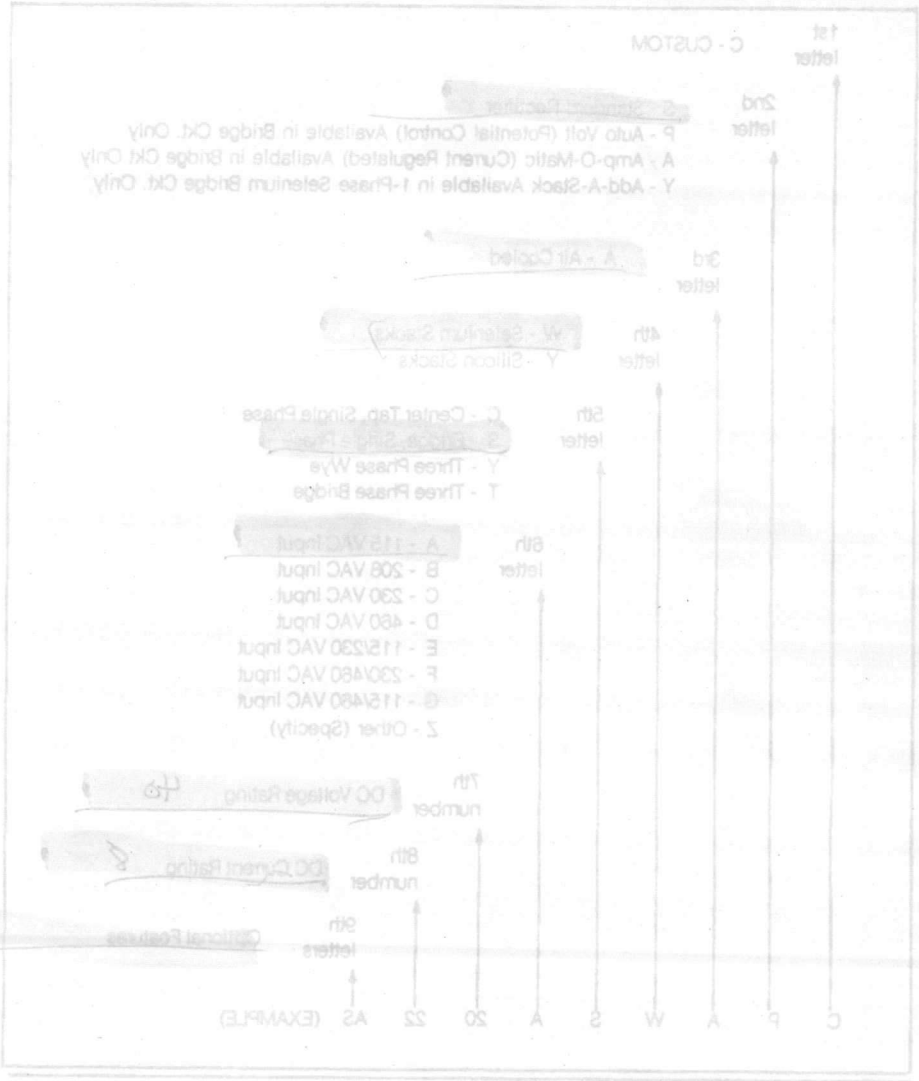
OPTIONAL FEATURES

Any of these features available for Custom-Air Rectifiers. (Symbol designates features available on † Add-A-Stack rectifiers).

A - Slide out racks for transformer & stack.
†C - Cross Arm mounting.
†D - Legs (specify) air cooled 10" standard;
E - Continuous reading meters.
F - Noise interference filter.
G - Efficiency filter.
H - Other than standard number of DC Output steps (standard has 20 steps) (specify). Add-A-Stack standard has 36.
J - Flashing signal light. (Continuous at normal current, flashing at undercurrent, out at loss of input.)
K - Continuous signal light. (Out at loss of input, output or at undercurrent.)
†L - Lightning protection for AC input only.
†M - Lightning protection for DC output only.
†N - Lightning protection for both input and output.
†P - Special finishes (specify).
†Q - Export crating.
R - Interrupter Circuit
†S - Small arms proof (11 gauge front, side and back).
T - Higher ambient temperatures (specify).
†V - Non standard access knockouts (specify).
Y - Input frequency other than 60 cycle (specify).
Z - Any other features (specify).

CUSTOM-AIR
HOW TO ORDER

ORDER CODE



OPTIONAL FEATURES

Any of these features available for Custom-Air Rectifiers. (Symbol designates feature available on 1 Add-A-Stack rectifiers)

- 1C - Cross Arm mounting
- 1D - Legs (specify) air cooled 10" standard.
- 1E - Continuous reading meters.
- 1F - Noise interference filter.
- 1G - Efficiency filter.
- 1H - Other than standard number of DC Output steps (standard has 20 steps) (specify). Add-A-Stack standard has 36.
- 1J - Flashing signal light. (Continuous at normal current, flashing at undercurrent, out at loss of input.)
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- 1Q - Export crating.
- 1R - Interrupter Circuit
- 1S - Small arms proof (11 gauge front, side and back).
- 1T - Higher ambient temperatures (specify).
- 1V - Non standard access knockouts (specify).
- 1Y - Input frequency other than 60 cycle (specify)
- 1Z - Any other features (specify).

HARCO CORPORATION

Corrosion Engineering Division

HARCO

[redacted]

RESTORE
CATHODIC PROTECTION TO WATER TANKS
CAMP LEJEUNE, NORTH CAROLINA
CONTRACT N62470-79-B-2646

OPERATING AND INSTRUCTION MANUAL

SEPTEMBER, 1981

RESTORE CATHODIC PROTECTION TO WATER TANKS
CAMP LEJEUNE, NORTH CAROLINA
CONTRACT N62470-79-B-2646

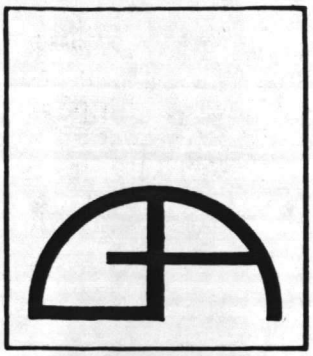
OPERATING AND INSTRUCTION MANUAL

The above contract was for replacing hi-silicon cast iron anodes, four (4) manual rectifiers, repair three (3) manual rectifiers and to replace wire and appurtenances at specified locations. Two of the three rectifiers that were to be repaired were deemed irreparable due to age, and a change order was issued. All anodes and rectifiers were replaced as described on NAVAC Drawing No. 40219315.

The enclosed rectifier instruction manual will serve not only for the six new rectifiers, but also for the nine existing rectifiers, since they are all basically the same with the exception of capacity. Operating levels of each tank are shown on the field service reports.

Duriron hi-silicon cast iron 1-1/8" X 9" segmented Type FW anodes were installed in each tank of a given quantity. Each segment weighs one pound and has a consumption rate of 0.25 pounds per ampere year. Anode life can be determined by multiplying 0.25 x applied amperage, divided into total anode weight. The resulting figure will then be calculated to be 50% efficient.

It is essential that each water tank be observed at least twice a month to assure that the systems are operating within the parameters as established in the field reports. Annual service should be entered into by the Owner so that the system can be inspected for deficiencies and re-adjusted for environmental changes, such as water chemistry, coating deterioration, etc. The company supplying this service shall have had no less than five continuous years of experience in servicing cathodic protection on water tanks and shall be accomplished by or under the direction of a Corrosion Specialist certified by the National Association of Corrosion Engineers (NACE).



GOOD-ALL

INSTRUCTION MANUAL

A219

GOOD-ALL ELECTRIC, INC.

INSTRUCTION MANUAL

FOR

CATHODIC PROTECTION RECTIFIERS

INDEX

INTRODUCTION

Good-All rectifiers are sold and serviced by leading corrosion protection firms throughout the world. These firms have the facilities and personnel required to design and install and maintain your corrosion protection systems.

Stock of sub-assemblies and components are maintained at our plant to enable "build to order" shipments to be made quickly. Our skilled Engineering staff has years of field and design experience, and is well equipped to provide specialized rectifiers when ever the application warrants the additional cost.

World-wide acceptance of Good-All rectifiers is the result of rigid quality control as a basic part of the manufacturing process. Close attention to quality control of components, manufacturing processes and finished assemblies guarantee you the finest, most reliable rectifiers in the world.

Corrosion of underground pipelines and other structures is a process which is continuous 24 hours per day, 365 days per year; and protection must also be continuous to effectively combat corrosion. Correct selection, installation and operation of a cathodic protection system is important, as severe corrosion could result from interruptions in protection. Reliability must be the chief criteria in the design of a cathodic protection installation. The Design Engineer can provide significant savings to his company in dollars and manpower by specifying Good-All rectifiers, which are backed by years of outstanding reliability history. We salute your good judgment in adding another Good-All rectifier to your system.

Rectifiers received in damaged condition should be accepted, a notation made on the freight bill and a claim made to the carrier. Concealed damage should be reported to the carrier immediately. Any type damage should be reported to the carrier, all cartons or crates saved in original condition and claim made to the carrier. Permission must be granted by Good-All before the return of any rectifiers for repairs.

When requesting information or ordering parts for this rectifier unit, please specify the serial number and model number. Information is available from our distributors located in convenient areas about this country, Canada and overseas.

Rectifiers manufactured by Good-All are guaranteed against defects in design, workmanship or material for a period of one year as described in our catalog. In any event, the obligation of Good-All is limited to the repair, adjustment or replacement at our factory of any rectifier or part thereof, which shall be found defective upon examination.

INSTALLATION AND OPERATION

Before installation, check for loose connections, and touch up scratches on the cabinet. A few minutes spent wisely before installation may save much trouble later.

Following are some installation tips which may be helpful:

1. The site of the installation is important. It should be at a location which is easily accessible so the rectifier can be inspected and adjusted regularly, and yet not near residential districts, play grounds, etc., where vandalism may be a problem.

   If the rectifier is mounted around livestock, it should be fenced in or mounted high enough so they cannot scratch on it. If installed in remote areas open to hunting, it should be made as inconspicuous as possible. Avoid placing bright symbols or markings on the rectifier which would make good targets.

2. Adequate ventilation is important. Install the rectifier away from building ventilator shafts, diesel exhausts, etc., keep an adequate distance from buildings or other devices. Air cooled rectifiers are cooled by convection (air moving over the components) and heat radiating through the sides of the cabinet. Keep the cabinet at least one foot away from the other objects. Oil immersed units are cooled by the circulation of the oil over the components and radiation of heat through the sides and top of the tank. (Use only transformer oil without inhibitor additives.) Nothing of an insulating nature should be applied to the case such as mastic, tar and etc.

   If possible, place the unit in the shade. Mounting it on the North side of the pole will help. If the ambient temperature is extremely high, a sunshade is a good investment.

3. Most codes require a fused, visible disconnect switch ahead of the rectifier. When working on the rectifier, make certain this switch is open, since voltage is present on the line side of the circuit breaker even when it is turned off.

4. Lightning arresters are cheap insurance when the rectifier is located in areas of frequent thunder storms. The AC arrester is best placed at the top of the service pole; but is effective even when placed inside the unit. AC and DC lightning arresters should be standard equipment on all rectifiers with silicon stacks.

5. The following precautions should be observed on every rectifier installation:

   (A) The rectifier case should be connected to a ground rod driven at the location of the unit. Most manufacturers provide a grounding lug on the cabinet for this purpose.

   (B) Make certain before energizing the unit that the input voltage available is that for which the rectifier is designed.

   (C) Check the output connections for correct polarity.

   (D) Do not install other equipment in the rectifier cabinet. This invalidates the rectifier guarantee, since the manufacturer has no control over the quality of the equipment added. The additional equipment might also interfere with the cooling of the rectifier.

   (E) Make certain that the screens are not obstructed on air cooled cabinets. Do not place the Service Manual on the bottom screen.

   (F) On three phase units, make certain all three sets of adjustment taps are set alike.

6. Future ground-bed changes ought to be considered when a conventional rectifier is adjusted at or near maximum voltage or current. When initially adjusting the rectifier, start on the low adjusting taps and bring up the desired rating slowly. This keeps the power relatively low if a fault occurs and also helps the selenium stacks to re-form.

INSPECTION

Regular inspection and good records on all cathodic protection rectifiers can result in less outages, better performances and lower cost in the long run. The following inspection procedure should be followed at least twice each year, or preferably, once a month.

The first part of any inspection of equipment is what is sometimes referred to as the "look, feel, smell" procedure. In a rectifier, this should be done on the inside and outside of the unit. On the inside, the first thing to check immediately after turning the unit off is the operating temperature of the plates by simply feeling the plates in each stack of the unit. Uneven operating temperature of the plates is a very definite indication of trouble. For example, in a four stack, single phase rectifier, if we should find that two stacks in the unit are warm and two stacks are cold, this can mean only one thing - lightning surge or some other hazard has damaged one of the stacks in the unit. Since a bridge rectifier containing four stacks has two pairs in a bridge, a fault in one of the stacks would completely eliminate one of the paths in the bridge which would cause the other path to carry all the current, and thus result in two warm stacks and two cold stacks. If this condition is allowed to continue with two of the stacks carrying all of the load, the result will be failure of the unit. Also, while the unit is operating in this manner, the output will be half-wave instead of full-wave, which causes interference problems.

Another thing to look for is the tell-tale burned arc that is caused by lightning when an arc has occurred across an insulator or some other component. Another check, which should be made as soon as possible after turning the unit off, is the operating temperature of all contacts throughout the unit. All bolted pressure type connections of any kind in a rectifier can become loosened and result in a bad contact, which will cause heating. The heating will cause oxidation resulting in still poorer contact; and this will continue until failure. Any of these can be spotted before actual trouble develops by simply checking the temperature of all contacts immediately after turning the unit off.

Proper cooling of all the components in the rectifier is always a problem. Accumulations of dust, bird or insect nests, or anything of this type on the components or on the screens can cause overheating and failure of the unit. Most rectifiers are ventilated through screens which have a maximum opening of 1/8". This will prevent the entrance of most insects that can cause trouble; therefore, special care should be taken to see that no holes in the unit are left unplugged to allow the insects to enter the rectifier.

While the unit is turned off, the electrical watt-hour meter should be checked for creep. The creep in the meter can indicate either a faulty electric meter or electrical leakage of some kind in the wiring to the unit. This leakage might be in the actual wiring itself or, if lightning arresters are used, could possibly be in the lightning arresters themselves.

For the next step, the unit should be turned on and the meters in the rectifier should be checked using portable voltmeters and ammeters, which are known to be accurate. The accuracy of the meters can be checked by a DC voltmeter and by connecting a 50 millivolt meter to the shunt in the unit. This check is possibly not necessary on each inspection; but should be carried out at least once per year. Poor contacts in meter switches can cause erroneous readings. This can

be avoided by pushing the switch and taking readings until four identical consecutive readings are obtained. The latest type Good-All meter switch is a sealed, submersible type, which will give many years of reliable operation.

The efficiency of the unit should then be checked. The efficiency of the unit is simply the ratio of the average DC output to the AC input times 100. The DC output is the DC volts times the DC amps.

$$\% \text{ Efficiency} = \frac{\text{DC Volts} \times \text{DC Amps}}{\text{AC Watts}} \times 100$$

The input can be determined by connecting a wattmeter into the primary circuit of the rectifier, or, in most cases, can be measured easier by counting the turns of the disc in the watt-hour meter and applying the following formula:

$$\text{AC Watts} = \frac{K \times N \times 3600}{T}$$

where K is the meter constant (shown on the dial face), N is the number of revolutions of the meter disc, and T is the time of measurement in seconds.

If a DC filter is present, the choke and capacitors should be visually inspected and checked for overheating. Each capacitor fuse should be inspected to insure the operation of all the capacitors. Poor filtering will decrease efficiency of the unit, and may cause interference problems.

The above outlined inspection procedure should take approximately one hour's time. If complete records of this inspection are maintained, a history of the unit will be developed, which will make it possible to determine the remaining life of the rectifier, and predict its performance and dependability. In most cases, this inspection can be carried out in connection with routine checks of the cathodic protection system, in connection with routine pipe line patrols, or other operations.

The efficiency record is particularly helpful because as stacks age in a rectifier, the efficiency will drop, and any sudden changes in the efficiency is usually an indication that some component is faulty. In most cases where the efficiency of the rectifier has dropped 20%, the increased power consumption is costing enough money that it would be cheaper to replace the stacks in the unit. This would also result in better performance of the unit. When checking efficiencies, only D'Arsonval type DC meters should be used. The first reading in the efficiency record should be the one supplied by the manufacturer showing what the efficiency was when the machine was inspected at the factory. (See Page 9). The efficiencies, which should be expected of various types of rectifiers, can be found in the engineering data contained in the Good-All catalog.

TROUBLE SHOOTING

If an inspection reveals that a unit has failed or is about to fail, then the trouble shooting procedure should be followed to locate the faulty component or components so that the unit may be restored to good operation. To be able to do trouble shooting in a rectifier, as with any machine, it is essential that the basic operation be understood completely.

The simplest way to approach a trouble shooting procedure to locate a faulty component is to study the flow of power through the unit. Therefore, in this discussion, the components which are used will be studied, starting from the input of the unit and carrying it through to the output.

If the flow of power is studied by first starting at the AC line which feeds power into the unit, the first component may be a lightning arrester. In this case, a by-pass for high surges entering the machine as a result of lightning. In most rectifiers, the first component will be the circuit breaker. The circuit breaker may be a magnetic type, thermal overload protector, or in some cases a fused switch. In all cases, it should be some type of breaker which can be used to turn the unit off and on, and will also provide overload and short circuit protection. Circuit breakers can sometimes develop bad contacts; therefore, if the unit is completely inoperative, the potential across the load side of the circuit breaker should be checked before proceeding. If the rectifier is a single voltage rectifier, the load side of the circuit breaker will be connected to the primary of the transformer. If the unit is a dual voltage rectifier, it is equipped with a voltage change-over panel; and since it has mechanical or pressure type contacts, this point should always be checked for open circuits or poor connection.

The next potential to be checked going through the unit would be the secondary of the transformer. This can be done by checking between any two of the terminals in the circuit that is used for changing the output of the rectifier. The secondary AC voltage of the transformer should appear between the center studs on the voltage change panel, and the amount of voltage between these two points would be determined by the rating of the machine and the setting of the bar link adjustments. No voltage between these points could possibly be caused by poor connections in the bar links. The next component in the unit, is the rectifier stack which changes AC into DC.

An assumption that a rectifier is inoperative or has no output may come as a result of no reading on the voltmeter or ammeter. However, one should not overlook the fact the voltmeter or ammeter itself could be at fault. Therefore, the meters should always be checked by substituting a portable meter, which is known to be good.

Some rectifiers may contain a filter in the DC output which is used to increase conversion efficiency and/or reduce interference. In most cases, this will be what is referred to as a single L section filter. This will consist of a choke connected in series with one of the DC leads and capacitors connected between the positive and negative terminals on the output of the machine. (See page 8 for a typical circuit of a filter).

Many special features may be incorporated in the rectifier; such as secondary breaker protection, alarm circuits, etc. The best sources of circuit information are the lettered pages in the rear of this Instruction Manual.

Insulation testers, such as Meggers or Vibra-grounds are preferred for high-potential circuit testing. However, if such is not available, the inexpensive trouble light may be used.

As an example, if it is desired to check for a fault between the secondary of the transformer and case, disconnect the voltage adjustment bar links to isolate the secondary from the stacks. Then connect the trouble light between one of the hot AC primary lines coming into the unit and the secondary of the transformer. The hot line may be located by connecting the light between a line and ground. If it is a hot line, and the bulb is good, it will light. If there is no fault in the secondary, the light bulb will not glow. However, if the secondary should be shorted to ground, the bulb will light. Any 115 volt light bulb can be used; even on higher voltage machines. If 230 or 440 volt power is used in the machine and the trouble light is connected between the high voltage line and a component and there is a short, all that could happen is that the light bulb may burn out.

The following outline includes some good examples of difficulties encountered in rectifiers and trouble shooting procedure which may be used to locate the fault:

A. If no output voltage or current is obtainable at all, difficulty and remedy may be:

1. Breaker tripped (or fuse blown).
   a. If apparently due to steady overload, reduce output slightly.
   b. If breaker trips repeatedly even with output reduced, cause may be:
      (1) Short circuit (line-to-line or line-to-ground in some component). Isolate component, then check insulation with ohmmeter or megger.
   c. If breaker trips occasionally for no obvious reason, the cause may be:
      (1) Temporary overload due to soil moisture changes.
      (2) Line voltage surges, or wrong line voltage connections. Adjust rectifier for operation at proper line voltage for the location.
      (3) Intermittent short circuits. Isolate and check with megger.
      (4) Sun heat, on thermal elements. Install a shade or shield.
      (5) Thermal elements or magnetic coils too small for load.

2. No AC line voltage - use AC voltmeter of proper range to check.

3. Open circuit in some component or connection.
   a. Check all connections, especially:
      (1) AC line voltage selector.
      (2) Fine and coarse transformer taps.
      (3) Stack connections.

b. Rectifier stacks. Use AC voltmeter to see that there is voltage being applied to the stacks.
   (1) If so, they may be open circuited and should be checked further, and possibly replaced.
   (2) If not, something farther ahead in the circuit is open.

4. Meters defective.
   a. Use accurate portable DC meters to check them.
   b. Replace meters (or meter switches) if indicated.

5. Transformer defective - if AC line voltage is applied to the primary, but none is measureable at the secondary, check to see if there is an audible hum coming from the transformer.
   a. If so, the primary is operating, but the secondary is probably open.
   b. If not, the primary is probably open.
   c. Check the above conclusions by isolating the transformer and checking the DC resistances of the windings with an ohmmeter.
      (1) Primary should have around 1 to 10 ohms resistance.
      (2) Secondary should have 1 ohm or less.
      (3) If either of the resistances is quite high, the particular winding is effectively an open circuit and the transformer will have to be repaired or replaced. Make sure that the high resistance is in the winding and not in some connection lug.

6. Circuit Breaker (or thermal overload protector) defective. If the contacts don't close, they (or possibly the entire unit) should be repaired.

B. If maximum DC output voltage obtainable at rated DC current is only about half what it should be, the trouble may be:

1. Machine connected for higher line voltage than that on which it is being operated.

2. Half of the stacks open-circuited in a single phase machine, making the machine operate as a half-wave rectifier, instead of a full-wave unit.

3. Part of the stacks open-circuited in a three-phase machine, making the machine operate as a single phase rectifier, instead of a three-phase unit.

4. Stacks aged badly.

5. Improper transformer used. The maximum secondary voltage obtainable should be at least:

CIRCUIT	RATIO AC VOLTAGE VALUES TO DC UNIT RATING
SINGLE PHASE BRIDGE	1.2
SINGLE PHASE CENTER-TAP	2.4
THREE PHASE BRIDGE	0.8
THREE PHASE WYE	0.9

The AC Secondary voltage may run considerably higher than these values in some machines; especially low DC voltage units.

6. In a three-phase machine, in addition to the above, one phase may:

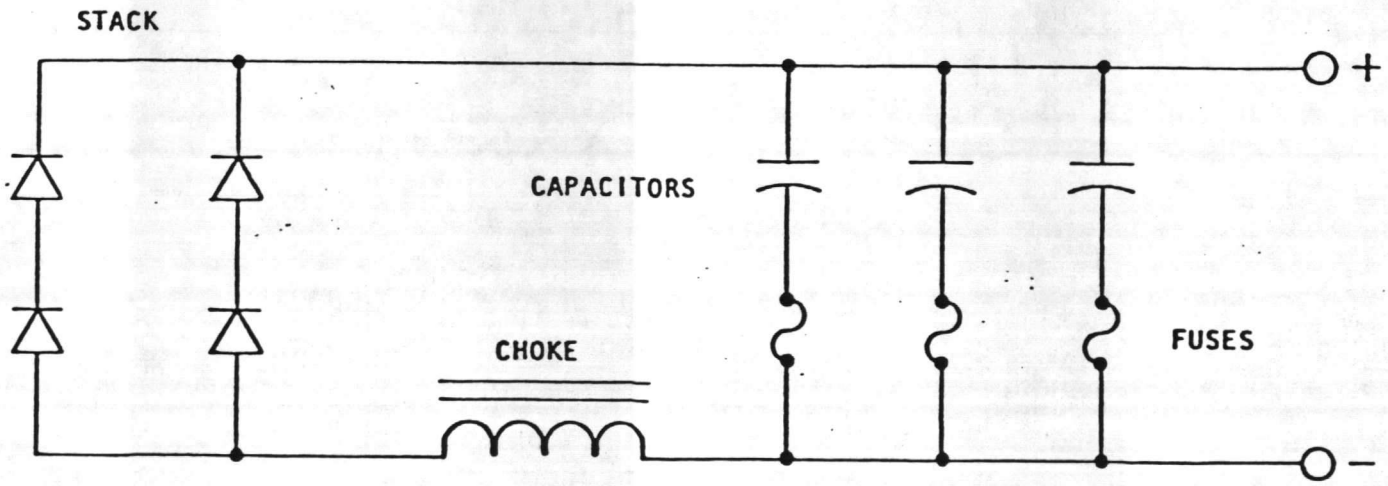
   a. Be open circuited, in which case the current in one AC line will be 10% or less of that in the other two.
   b. Have stacks that are aging more than the others, in which case the line current unbalance may be 1 to 50% or so. The defective stacks may be isolated by opening the secondary of each phase in turn, then checking the stack drop of the remaining stacks in the same way as for single phase.

7. Low line voltage.

Filter trouble-shooting is an important part of rectifier maintenance. Below is a circuit diagram of a filter. The component with the shortest life is the capacitor. A capacitor usually fails by shorting, therefore, each capacitor is individually fused to prevent a complete shut down of the rectifier and make the locating of the shorted capacitor easier. The capacitor fuses should be checked occasionally to insure proper operation of the filter. If a capacitor fuse blows, it should be replaced, the unit turned on, and then the fuse rechecked. This is necessary because a fuse may blow as a result of surges and the capacitor be undamaged. If the new fuse blows the capacitor should be replaced. Checking a capacitor with an ohmmeter is not dependable because the voltage applied is less than the operating voltage.

The choke in a filter circuit could fail by overheating due to overload, in which case the high temperature operations would show visible effects of burning. A choke could also fail by a short between the winding and the core. This could be checked by hi-pot or megger test.

RECTIFIER FILTER



GA 251

CUSTOM AIR STANDARD RECTIFIERS

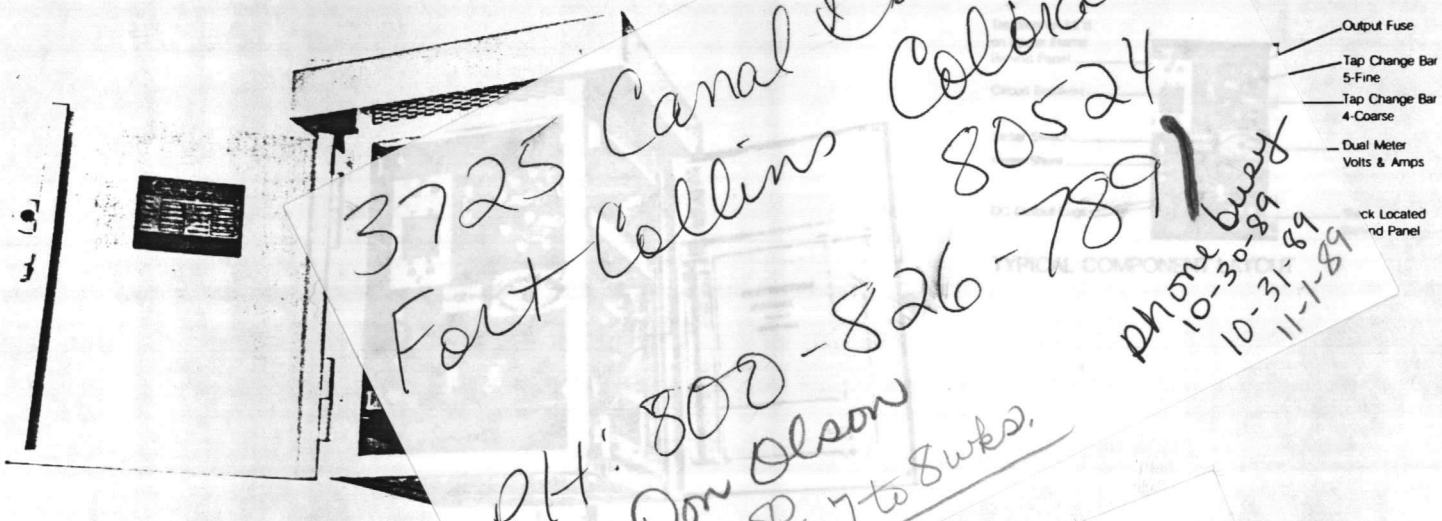
GOODALL

FEATURES

- Good-All Custom quality.
- Single-phase or three-phase input.
- 20 DC output adjustment steps.
- Silicon or Selenium stacks.
- No moving parts, relays, or contacts.
- Primary circuit components shielded from accidental contact.
- Full magnetic circuit breakers — no high ambient tripping.
- Red-Lined meters individually calibrated.
- Meets NEMA standards.

SPECIFICATIONS

- Heavy steel swing open case, with white baked-enamel finish.
- Standard Custom Rectifier Ratings
- 45°C Ambient temperature rating is standard.
- Custom-quality transformers, stacks and derating.
- Bridge rectifier circuits.
- Large 2% accuracy meters with switch to read volts & amps.
- Meets NEMA Standards.



3725 Canal Drive
Fort Collins Colorado 80524
PH: 800-826-7891
Attn: Don Olson
#712 50 7 to 8 wks.
phone busy 10-30-89 10-31-89 11-1-89
Room 752 Kinston Hospital
go straight
2:00
abscess

HOW TO ORDER (SEE ORDER CODE, PAGE 178-A-2)

ORDERING CODE EXAMPLE

C S A W S A PQ

- CUSTOM LINE
- STANDARD
- AIR COOLED
- SELENIUM
- 1-PHASE BRIDGE
- OPTIONAL FEATURES
- RATED DC AMP
- RATED DC VOLTS
- 115 V.A.C. INPUT

8, 8B, 9, 9B
e 178-A-2
178-A-1B

CUSTOM AIR STANDARD RECTIFIERS

GOODALL

FEATURES

- Good-All Custom quality.
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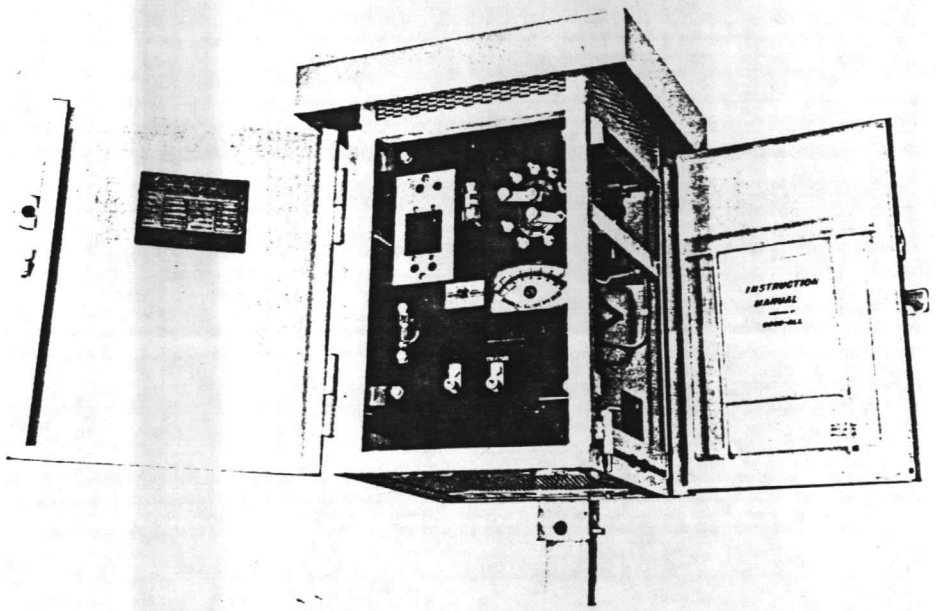
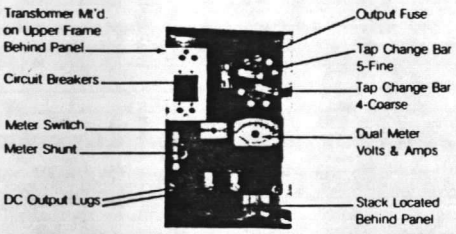




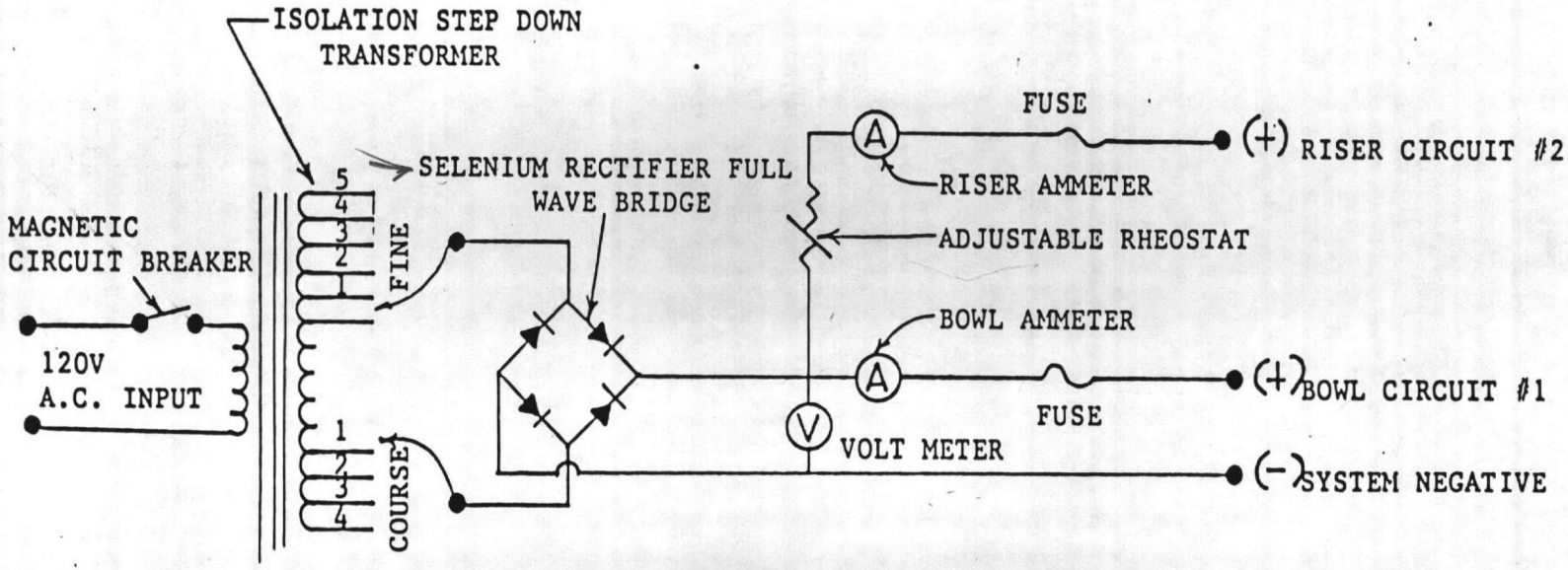
TYPICAL COMPONENT LAYOUT

HOW TO ORDER (SEE ORDER CODE, PAGE 178-A-2)

ORDERING CODE EXAMPLE

C	S	A	W	S	A	PQ
CUSTOM LINE						OPTIONAL FEATURES
	STANDARD					
		AIR COOLED				RATED DC AMPERES
			SELENIUM			RATED DC VOLTS
				1-PHASE BRIDGE		115 V.A.C. INPUT

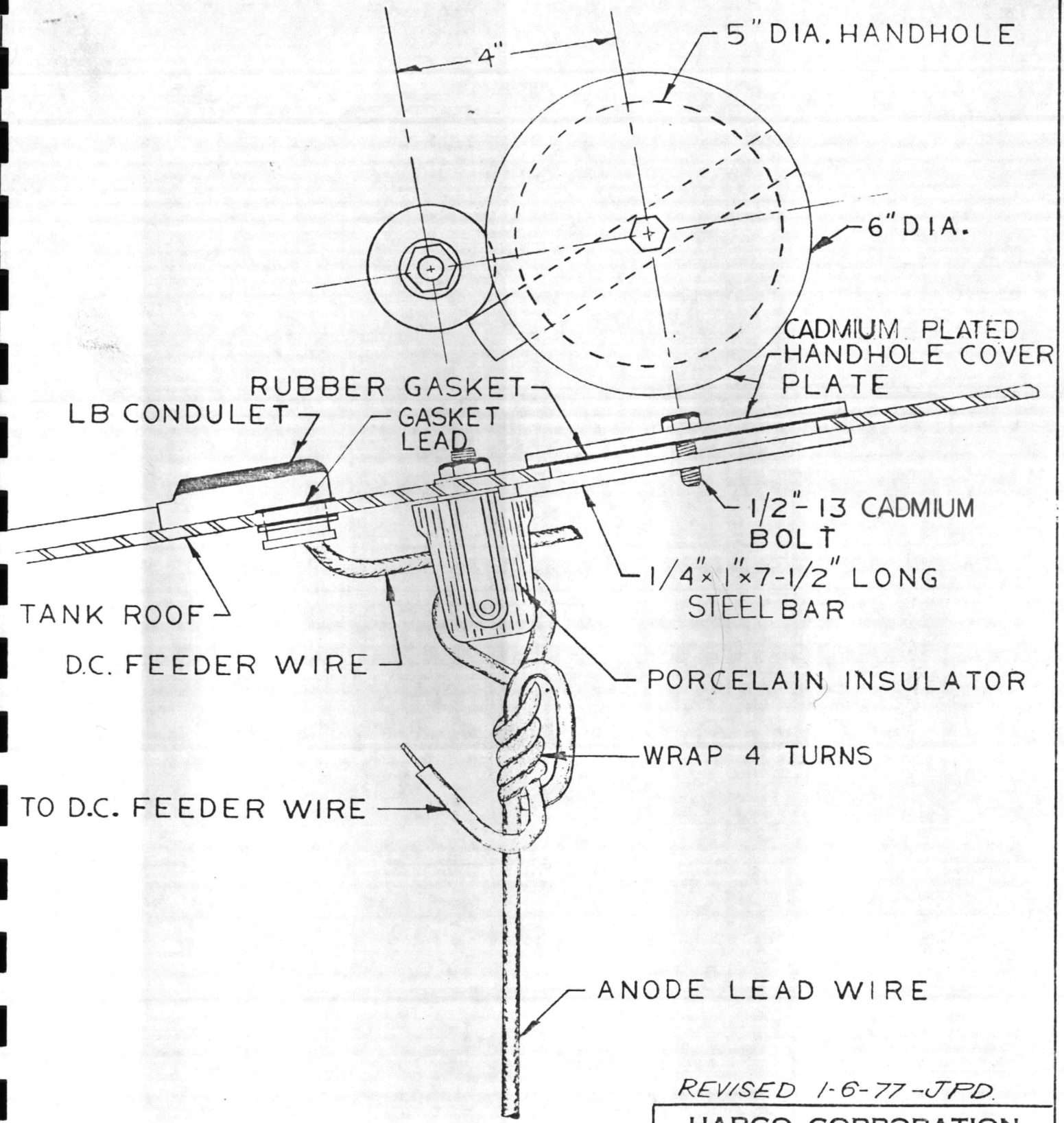
RATINGS See pages 178-A-7, 7B, 8, 8B, 9, 9B
OPTIONS ..... See page 178-A-2
CASE SIZES ..... See page 178-A-1B



HARCO CORPORATION
Corrosion Engineering Division
CLEVELAND · ATLANTA · CHICAGO
HOUSTON · LOS ANGELES · NEWARK

DRAWN BY: JEW
DATE: 9/9/81
DWG. NO. T-48844

CAMP LEJEUNE, NORTH CAROLINA
RESTORE CATHODIC PROTECTION
FIFTEEN (15) WATER TANKS
CONTRACT N62470-79-B-2646



REVISED 1-6-77-JPD

HARCO CORPORATION
CATHODIC PROTECTION DIVISION
4600 EAST 71st ST. CLEVELAND, OHIO 44125

BY: HAR	DATE 8-27-80	NO. 25522-T

HANDHOLE AND SUSPENSION DETAIL

AS BUILT

REPLACES DWG NO. 3205-A

DURCO *DUR-ANO-FLEX®* ANODES SUITABLE FOR FLEXIBLE ASSEMBLY

8-15-75

TECHNICAL DATA	[redacted]	G2	G2½	FC
PATTERN NUMBER	BS19331AB	BS12908AE	AS33213A	BS16936A
NOMINAL DIMENSIONS	1 1/8" x 9"	2" x 9"	2½" x 9"	1½" x 9"
WEIGHT – POUNDS	1	5	9	4
SURFACE AREA – SQUARE FEET	.26	.40	.50	.30
MAXIMUM CABLE SIZE	8/7	4/7	4/7	6/7
RECOMMENDED CABLE SIZE	8/7	4/7	4/7	8/7
RECOMMENDED DISCHARGE, AMPS.	.025	0.100	0.200	0.075
MINIMUM SPACING BETWEEN ANODES	1'	2'	2'	1'
GENERAL APPLICATIONS	Elevated fresh water tanks.	Underground cables in ducts or fresh water tanks.	Underground cables in ducts or distributed systems in ground trench.	Distributed systems in ground trench.

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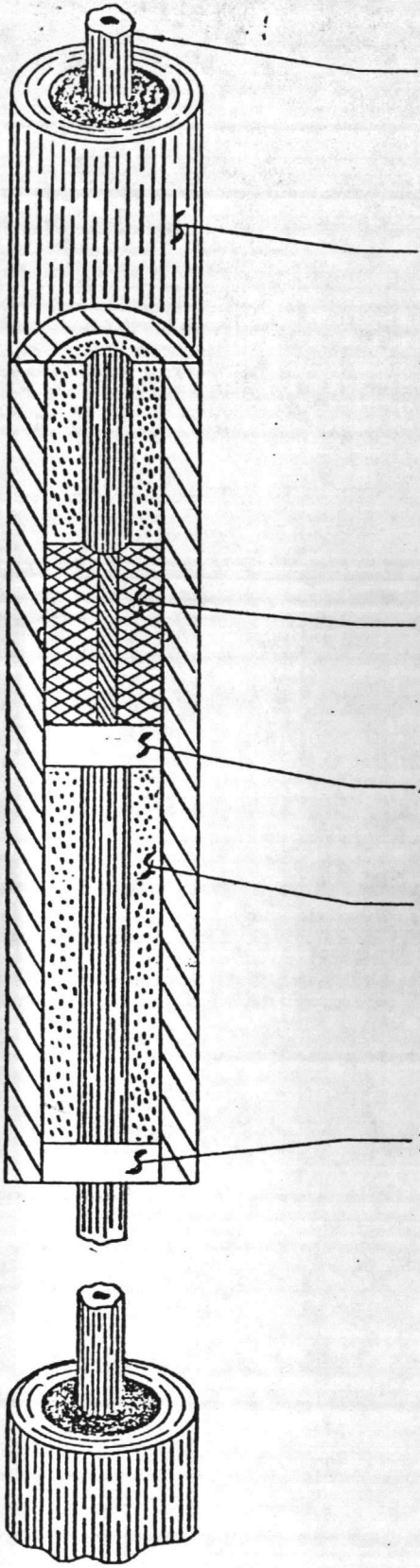

HARCO CORPORATION
Corrosion Engineering Division

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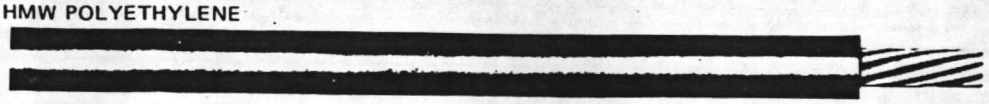
TYPICAL DURIRON FW
ANODE ASSEMBLY

BY: R.J.B.	DATE: 6-16-76	NO S-24919-A

TYPE CP CATHODIC PROTECTION CABLE

April, 1976

HMW POLYETHYLENE



1-conductor, combined HMW polyethylene insulation and jacket

DESCRIPTION: 1-conductor, stranded, plain, annealed copper; black high-molecular weight polyethylene insulation and jacket.

APPLICATION: The outstanding dielectric strength and moisture resistance of the high-molecular weight polyethylene, coupled with its high resistance to corrosive chemicals characteristic of the environments requiring cathodic protection, deservedly make this construction the work-horse of the cathodic protection cables. Polyethylene is resistant to salt water and most organic and inorganic substances. Conforms to ASTM Spec #D-1248, Type 1, Class C, Grade 5. Used for cathodic protection bed header cables, for return leads, for anode lead wires, for bonding.

HIGH-MOLECULAR-WEIGHT POLYETHYLENE – (HMW)

AP No. 06805

SIZE AWG OR MCM	NO. OF STRANDS	INSUL. JACKET THICK-NESS (INCH)	APPROX. O. D. INCHES	APPROX. SH. WT. LB./M FT.
[redacted]				
Ⓢ 6	7	7/64	.41	141
Ⓢ 4	7	7/64	.46	200
Ⓢ 2	7	7/64	.52	286
Ⓢ 1	19	8/64	.59	365
Ⓢ 1/0	19	8/64	.63	438
Ⓢ 2/0	19	8/64	.67	539
Ⓢ 4/0	19	8/64	.78	829
250	37	10/64	.89	991
300	37	10/64	.95	1184
350	37	10/64	.99	1353

QUANTITY OF EACH SIZE DETERMINES THE PRICE TO APPLY; DIFFERENT SIZES MAY NOT BE COMBINED TO OBTAIN LOWER PRICES. 10% CHARGE FOR WIRE LENGTHS LESS THAN 1000 FEET.

Prices are F.O.B. destination in continental United States, except Alaska, if served by common carrier, for shipments 1000 pounds and over. Shipments of less than 1000 pounds are F.O.B. point of shipment.

These items are shipped on non-returnable reels. No charge is made for the reels, and no credit will be allowed if they are returned.

Prices, terms and conditions are subject to change without notice.

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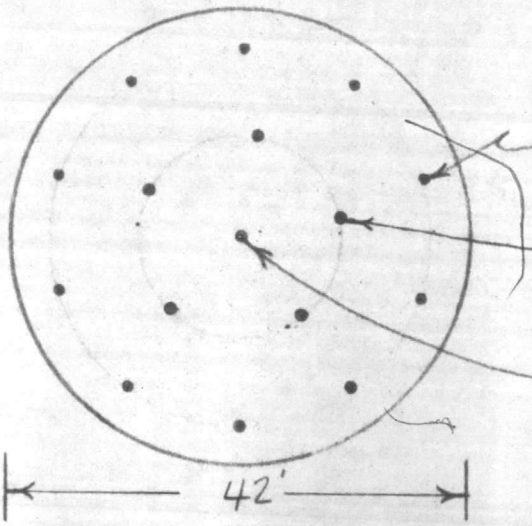


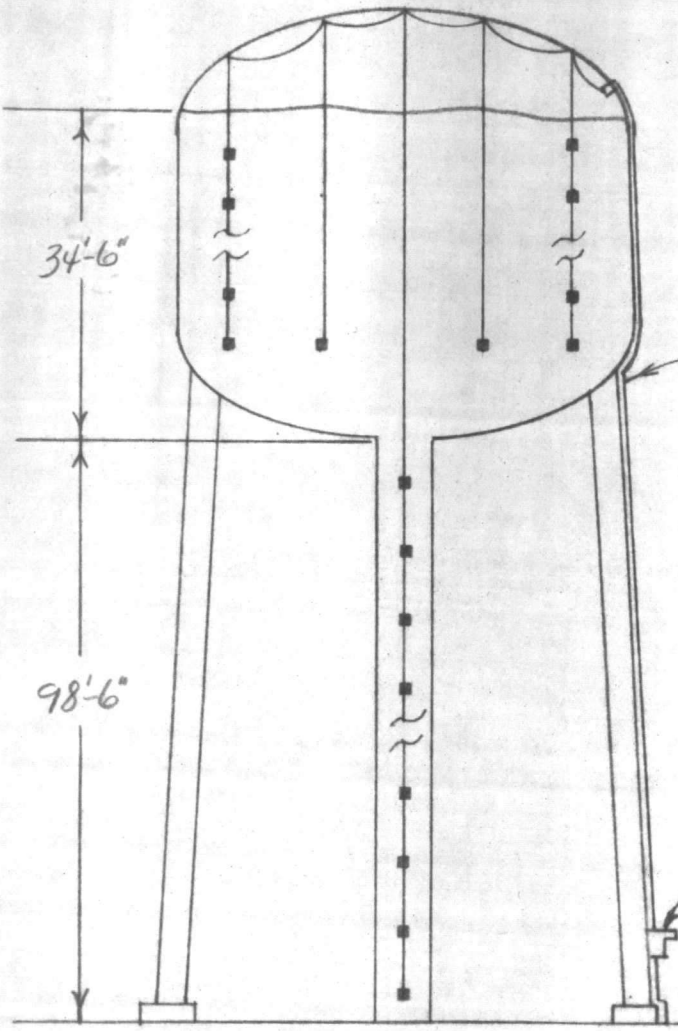
10 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 8 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

5 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 1 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

1 - NEW HIGH SILICON CAST IRON ANODE STRING CONTAINING 31 - 1-1/8" X 9" SEGMENTS ON A 0' RADIUS, 4' OFF BOTTOM

NOTE:

ALL HAND HOLE COVER GASKETS TO BE REPLACED WITH BUTYL RUBBER



1 - EXISTING CONDUIT. REMOVE EXISTING WIRE AND REPLACE WITH 2 - #12-7 STRAND THHN WIRE

1 - NEW GOODALL ELECTRIC 40 VOLT 20 AMP DUAL CIRCUIT MANUAL RECTIFIER CATALOG NO. CSAWSA 40-20. SYSTEM NEGATIVE MAY BE MADE AT OR NEAR RECTIFIER MOUNTING CHANNEL EXISTING 115/60/1Ø A.C. CONNECT BY HARCO

HARCO

HARCO CORPORATION
Corrosion Engineering Division

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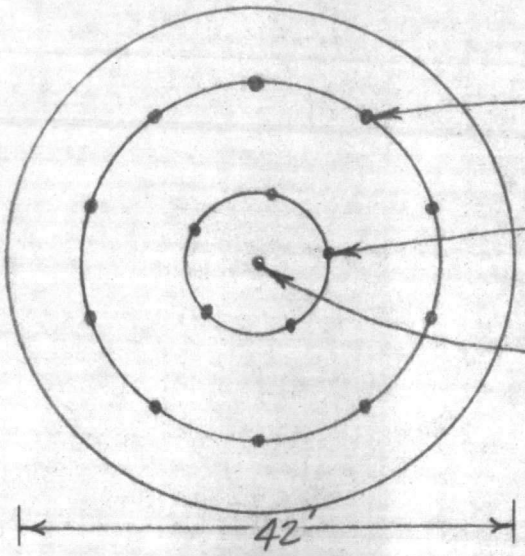
CATHODIC PROTECTION
300,000 GALLON TANK NO. S-1000
INDUSTRIAL AREA
CAMP LEJEUNE, NORTH CAROLINA

AS BUILT

BY: J.E.W.	DATE: 8-27-80	NO. T-48844-1



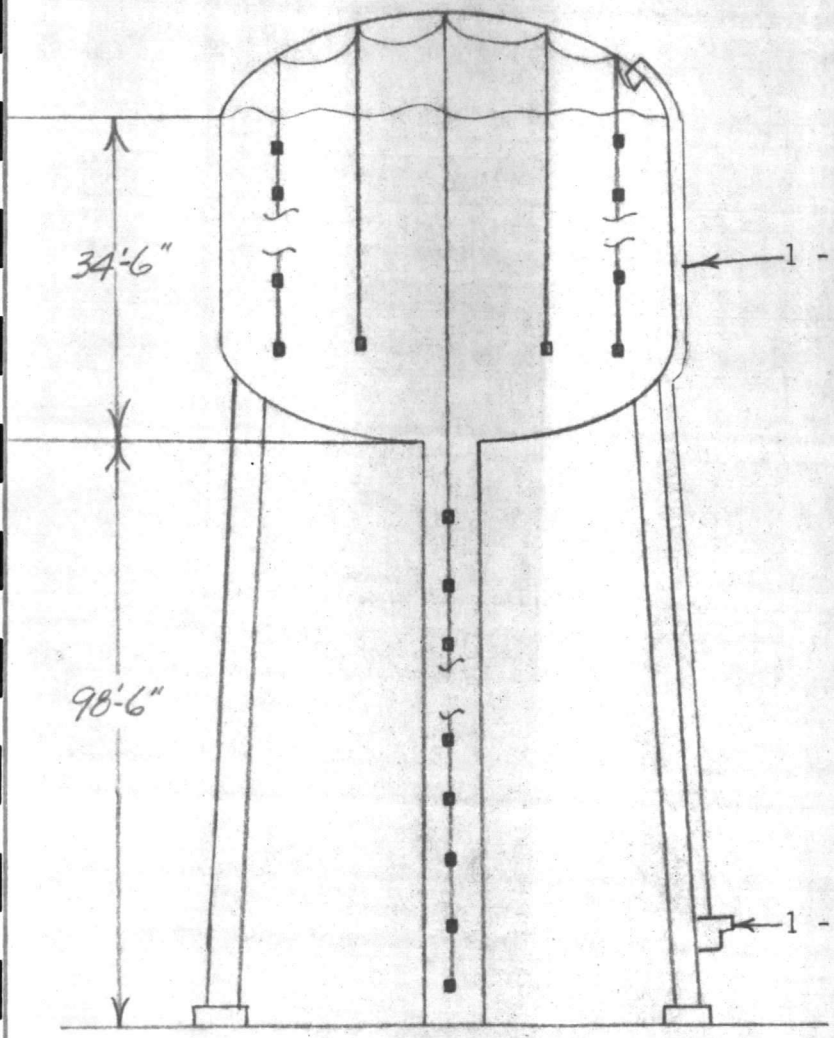
10 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 8 - 1-1/8" X 9" SEGEMNTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

5 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 1 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

1 - NEW HIGH SILICON CAST IRON ANODE STRING CONTAINING 31 - 1-1/8" X 9" SEGMENTS ON A 0' RADIUS, 4' OFF BOTTOM

NOTE:

ALL HAND HOLE COVER GASKETS TO BE REPLACED WITH BUTYL RUBBER



1 - EXISTING CONDUIT. REMOVE EXISTING WIRE AND REPLACE WITH 2 #12-7 STRAND THHN WIRE

1 - EXISTING 18 VOLT 20 AMP MANUAL RECTIFIER HARCO NO. 4106

HARCO

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Corrosion Engineering Division

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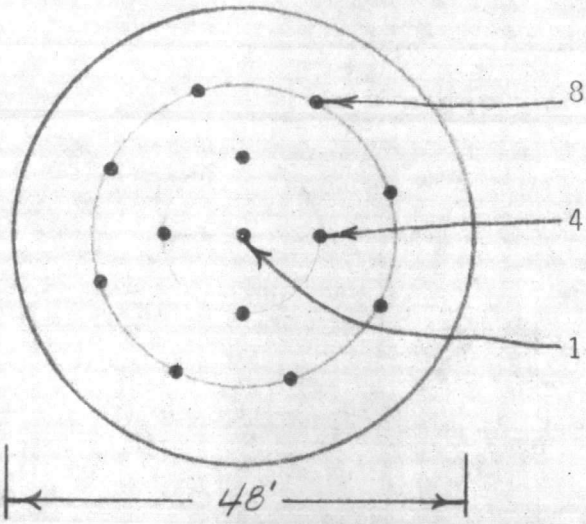
CATHODIC PROTECTION
300,000 GALLON TANK NO. S-29
50 AREA
CAMP LEJEUNE, NORTH CAROLINA

AS BUILT

BY: J.E.W.	DATE: 8-27-80	NO. T-48844-2



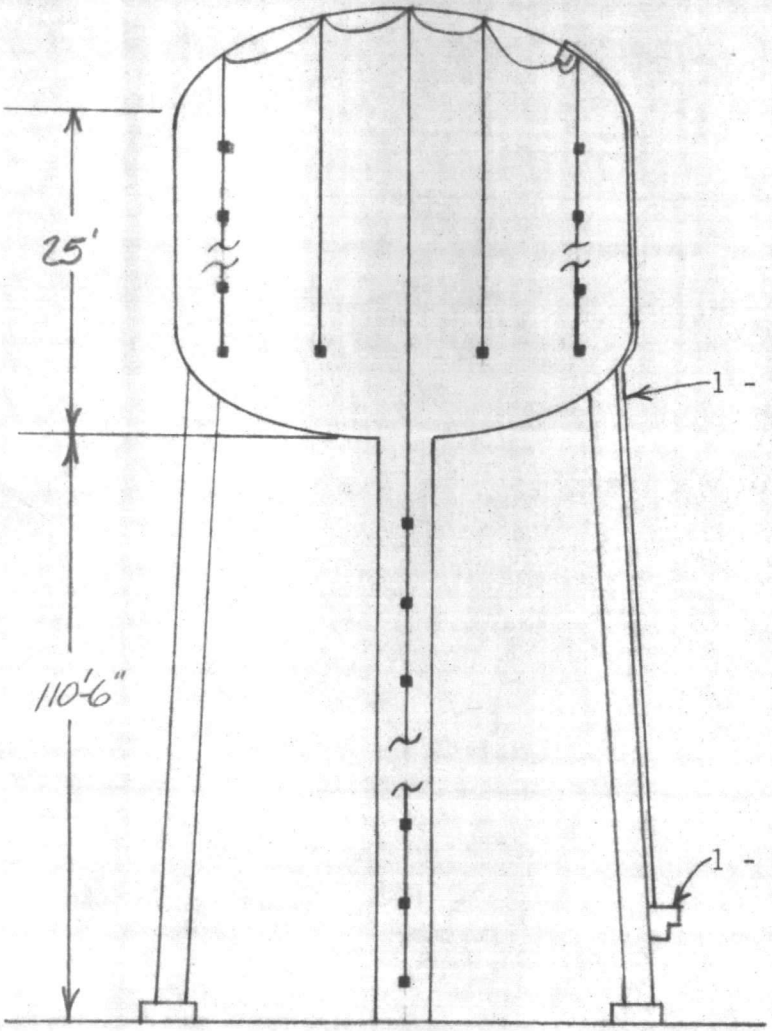
8 - NEW HIGH SILICON CAST RION ANODE STRINGS CONTAINING 6 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

4 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 1 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

1 - NEW HIGH SILICON CAST IRON ANODE STRING CONTAINING 31 - 1-1/8" X 9" SEGMENTS ON A 0' RADIUS, 4' OFF BOTTOM

NOTE:

ALL HAND HOLE COVER GASKETS TO BE REPLACED WITH BUTYL RUBBER



1 - EXISTING CONDUIT. REMOVE EXISTING WIRE AND REPLACE WITH 2 - #12-7 STRAND THHN WIRE

1 - EXISTING 20 VOLT 23.9 AMP MANUAL RECTIFIER HARCO NO. 2738

HARCO CORPORATION
Corrosion Engineering Division

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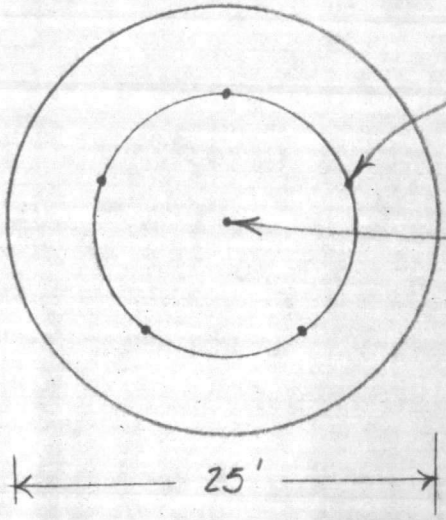
CATHODIC PROTECTION
~~250~~ 300,000 GALLON TANK NO. SFC 314
FORCE TROOPS
CAMP LEJEUNE, NORTH CAROLINA

AS BUILT

BY: J.F.W.	DATE: 8-27-80	NO. T-48844-3

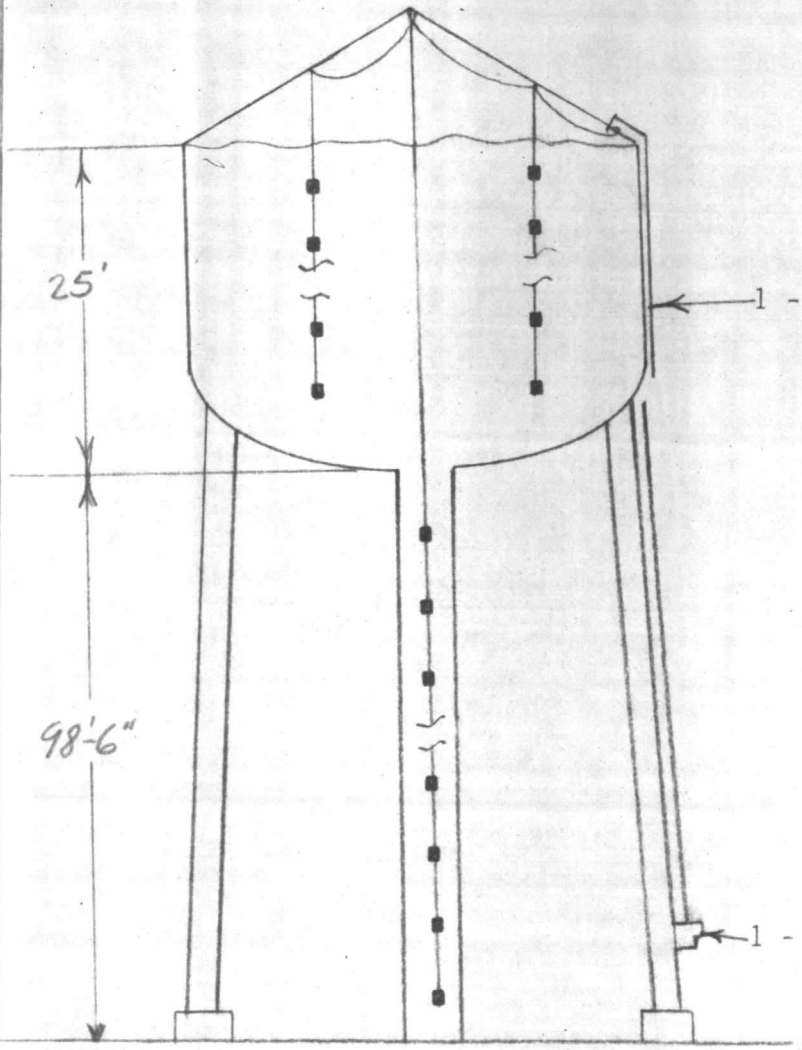


5 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 6 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

1 - NEW HIGH SILICON CAST IRON ANODE STRING CONTAINING 31 - 1-1/8" X 9" SEGMENTS ON A 0' RADIUS, 4' OFF BOTTOM

NOTE:

ALL HAND HOLE COVER GASKETS TO BE REPLACED WITH BUTYL RUBBER



1 - EXISTING CONDUIT. REMOVE EXISTING WIRE AND REPLACE WITH 2 - #12-7 STRAND THHN WIRE

1 - EXISTING 18 VOLT 10 AMP MANUAL RECTIFIER HARCO NO. 4104

HARCO

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Corrosion Engineering Division

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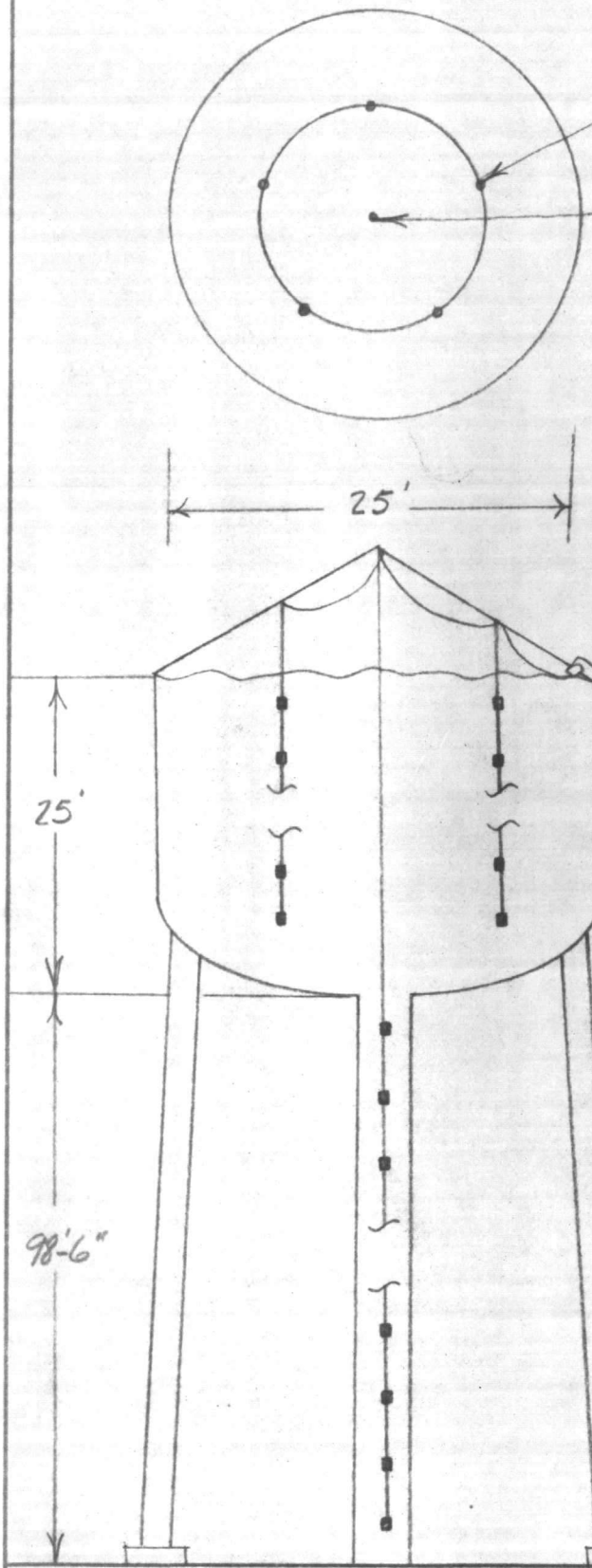
CATHODIC PROTECTION
100,000 GALLON TANK NO. S-BB-25
COURTHOUSE BAY
CAMP LEJEUNE, NORTH CAROLINA

AS BUILT

BY	DATE	NO.
J.E.W.	8-27-80	T-48844-4



5 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 6 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

1 - NEW HIGH SILICON CAST IRON ANODE STRING CONTAINING 31 - 1-1/8" X 9" SEGMENTS ON A 0' RADIUS, 4' OFF BOTTOM

NOTE:

ALL HAND HOLE COVER GASKETS TO BE REPLACED WITH BUTYL RUBBER

1 - EXISTING CONDUIT. REMOVE EXISTING WIRE AND REPLACE WITH 2 - #12-7 STRAND THHN WIRE

1 - NEW GOODALL ELECTRIC 40 VOLT 20 AMP DUAL CIRCUIT MANUAL RECTIFIER CATALOG #CSAWSA 40-20. SYSTEM NEGATIVE MAY BE MADE AT OR NEAR RECTIFIER MOUNTING CHANNEL.

EXISTING 115/60/1Ø CONNECT BY HARCO

HARCO

HARCO CORPORATION
Corrosion Engineering Division

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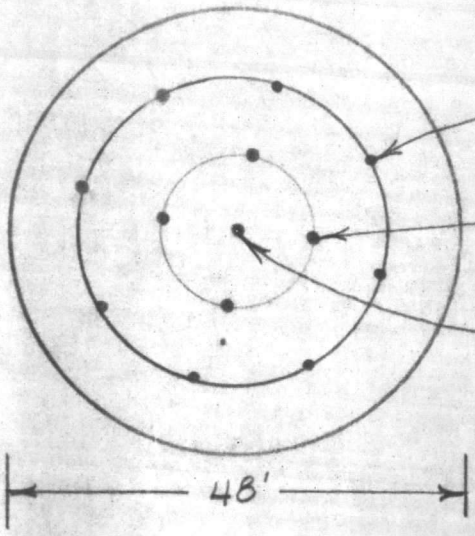
CATHODIC PROTECTION
100,000 GALLON TANK NO. S-RR-44
RIFLE RANGE
CAMP LEJEUNE, NORTH CAROLINA

AS BUILT

BY J.E.W.	DATE 8-27-80	NO. T-48344-5



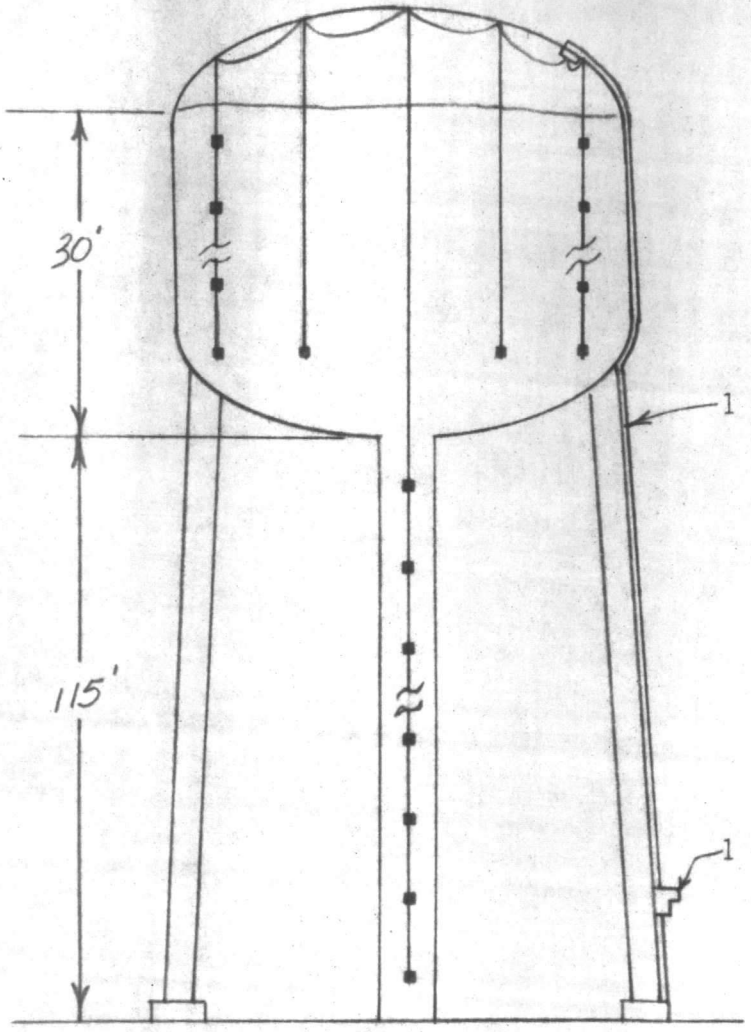
8 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 8 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

4 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 1 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

1 - NEW HIGH SILICON CAST IRON ANODE STRING CONTAINING 36 - 1-1/8" X 9" SEGMENTS ON A 0' RADIUS, 4' OFF BOTTOM

NOTE:

ALL HAND HOLE COVER GASKETS TO BE REPLACED WITH BUTYL RUBBER



1 - EXISTING CONDUIT. REMOVE EXISTING WIRE AND REPLACE WITH 2 - #12-7 STRAND THHN WIRE

1 - EXISTING 60 VOLT 28 AMP MANUAL RECTIFIER HARCO NO. 9339. REBUILD WITH REPLACEMENT OF TRANSFORMER, SELENIUM STACK AND ALL METERS

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Corrosion Engineering Division

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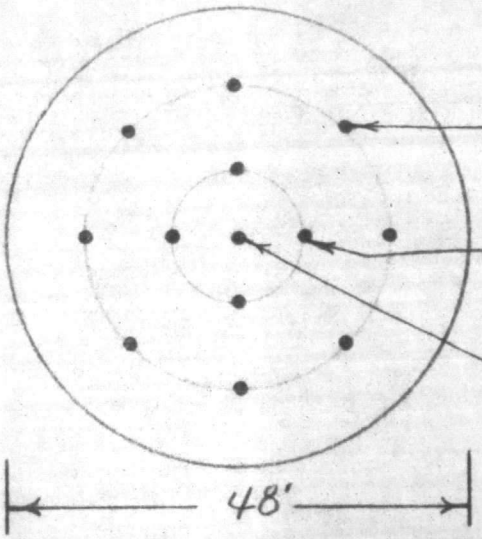
CATHODIC PROTECTION
350,000 GALLON TANK NO. 4130
AIR STATION WHITE STREET
CAMP LEJEUNE, NORTH CAROLINA

AS BUILT

BY: J.E.W.	DATE: 8-27-80	NO. T-48844-6



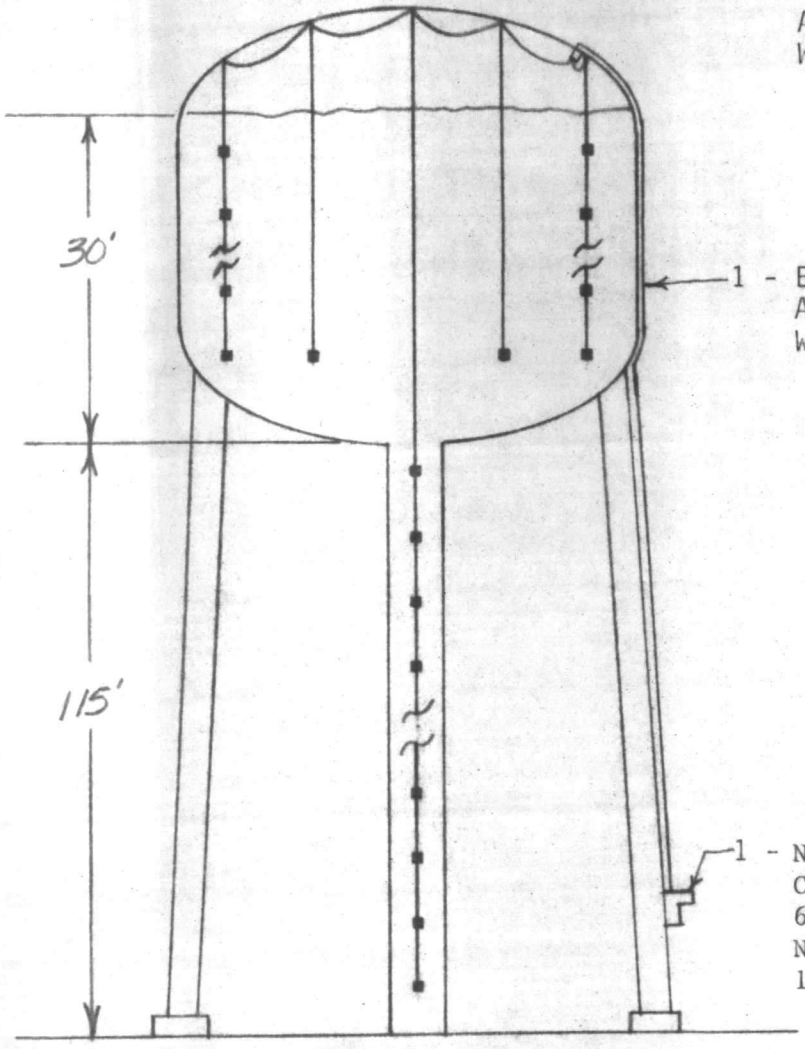
8 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 8 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

4 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 1 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

1 - NEW HIGH SILICON CAST IRON ANODE STRING CONTAINING 36 - 1-1/8" X 9" SEGMENTS ON A 0' RADIUS, 4' OFF BOTTOM

NOTE:

ALL HAND HOLE COVER GASKETS TO BE REPLACED WITH BUTYL



1 - EXISTING CONDUIT. REMOVE EXISTING WIRE AND REPLACE WITH 2 - #12-7 STRAND THHN WIRE

1 - NEW GOODALL ELECTRIC 60 VOLT 28 AMP DUAL CIRCUIT MANUAL RECTIFIER CATALOG NO. CSAWSA 60-28. SYSTEM NEGATIVE MAY BE MADE AT OR NEAR RECTIFIER MOUNTING CHANNEL. EXISTING 115/60/1Ø A.C. CONNECT BY HARCO.

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Corrosion Engineering Division

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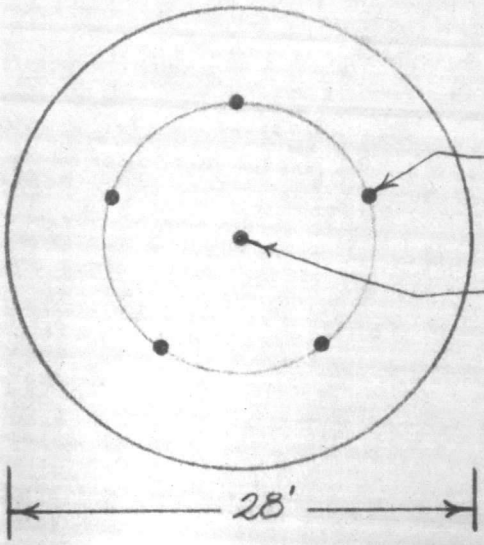
CATHODIC PROTECTION
350,000 GALLON TANK NO. 310
AIR STATION CAMPBELL STREET
CAMP LEJEUNE, NORTH CAROLINA

AS BUILT

BY: J.E.W.	DATE: 8-27-80	NO. T-48344-7

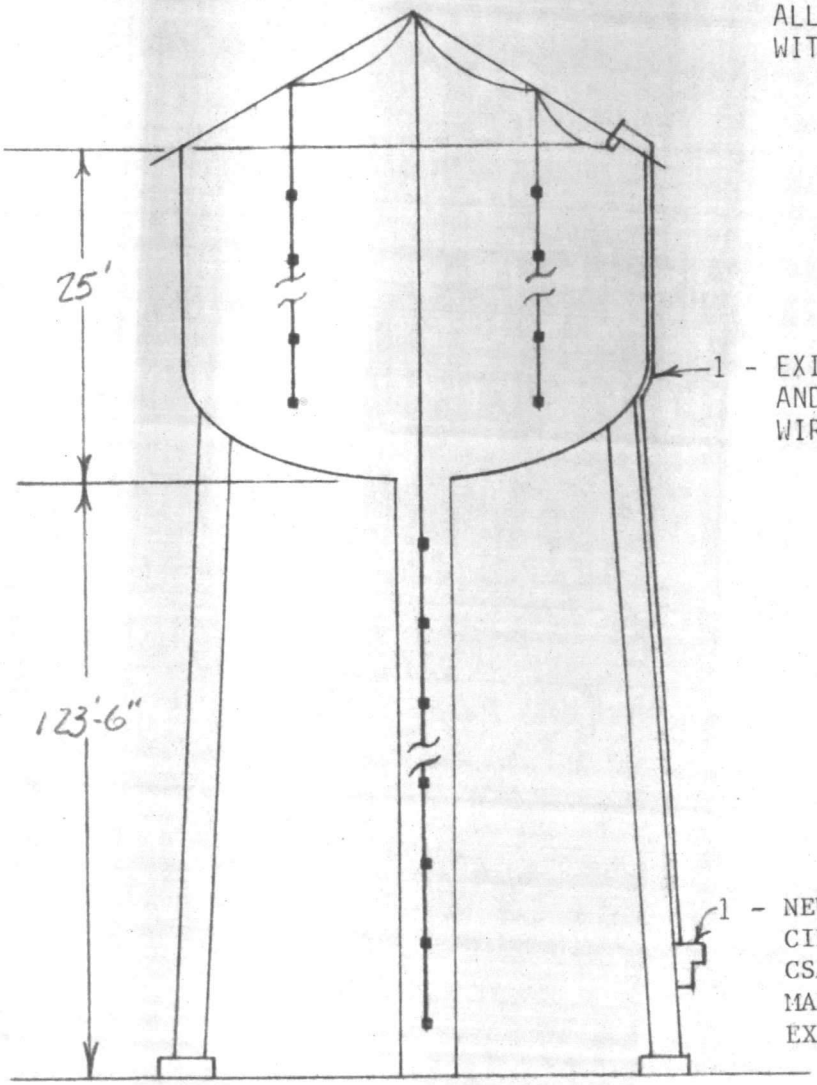


5 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 6 - 1-1/8" X 9" SEGMENTS ON EXISTING RADIUS, 3' OFF BOTTOM

1 - NEW HIGH SILICON CAST IRON ANODE STRING CONTAINING 39 - 1-1/8" X 9" SEGMENTS ON A 0' RADIUS, 4' OFF BOTTOM

NOTE:

ALL HAND HOLE COVER GASKETS TO BE REPLACED WITH BUTYL RUBBER



1 - EXISTING CONDUIT. REMOVE EXISTING WIRE AND REPLACE WITH 2 - #12-7 STRAND THHN WIRE

1 - NEW GOODALL ELECTRIC 40 VOLT 12 AMP DUAL CIRCUIT MANUAL RECTIFIER CATALOG NO. CSAWSA 40-12. SYSTEM NEGATIVE MAY BE MADE AT OR NEAR RECTIFIER MOUNTING CHANNEL. EXISTING 115/60/1Ø A.C. CONNECT BY HARCO.

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Corrosion Engineering Division

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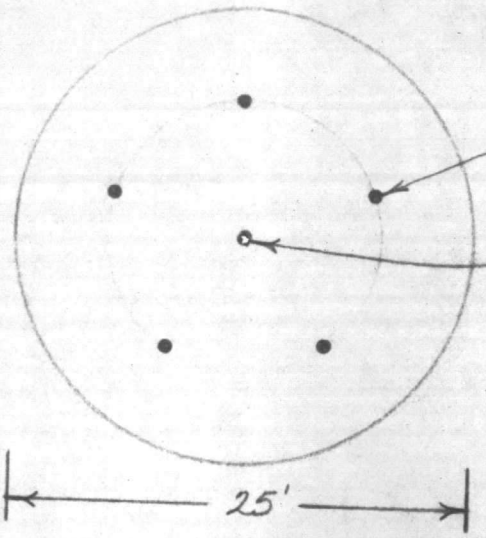
CATHODIC PROTECTION
100,000 GALLON TANK NO. S-TC-1070
GEIGER SOUTH
CAMP LEJEUNE, NORTH CAROLINA

AS BUILT

BY	J.E.W.	DATE	8-27-80	NO.	T-48844-8

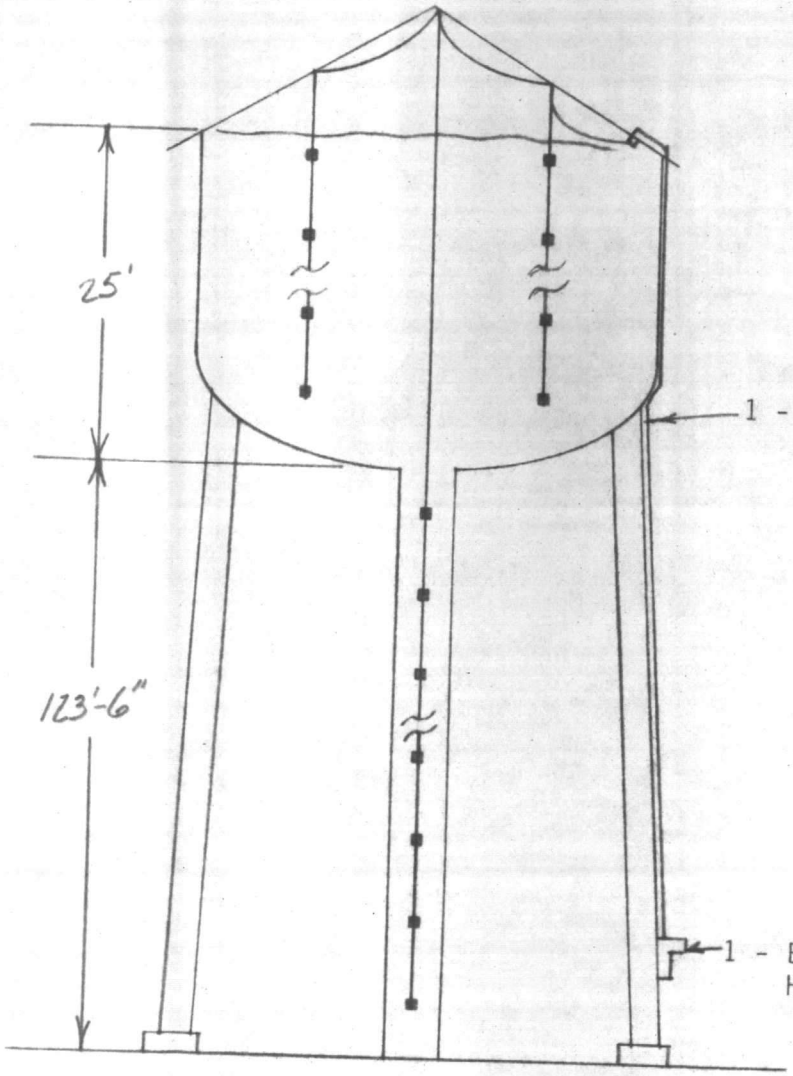


5 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 6 - 1-1/8" X 9" SEGMENTS ON EXISTING RADIUS, 3' OFF BOTTOM

1 - NEW HIGH SILICON CAST IRON ANODE STRING CONTAINING 39 - 1-1/8" X 9" SEGMENTS ON A 0'. RADIUS, 4' OFF BOTTOM

NOTE:

ALL HAND HOLE COVER GASKETS TO BE REPLACED WITH BUTYL RUBBER



1 - EXISTING CONDUIT. REMOVE EXISTING WIRE AND REPLACE WITH 2 - #12-7 STRAND THHN WIRE

1 - EXISTING 40 VOLT 12 AMP MANUAL RECTIFIER HARCO NO. 7236

HARCO

HARCO CORPORATION
Corrosion Engineering Division

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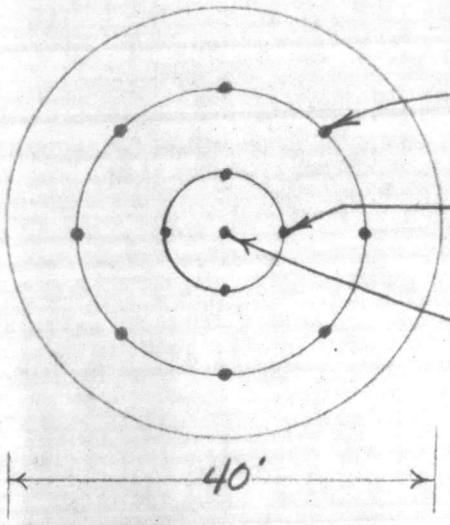
CATHODIC PROTECTION
100,000 GALLON TANK NO. S-TC-606
GEIGER NORTH
CAMP LEJEUNE, NORTH CAROLINA

AS BUILT

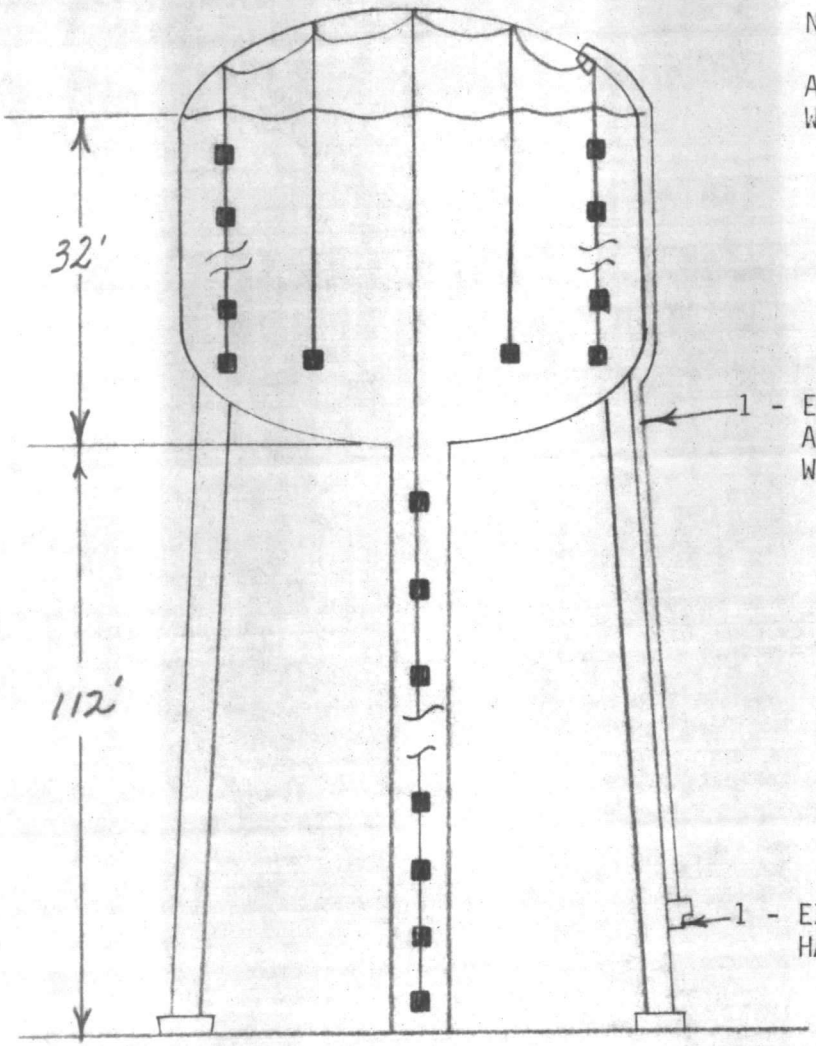
BY: J.E.W.	DATE: 8-27-80	NO. T-48844-9



8 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 8 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

4 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 1 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

1 - NEW HIGH SILICON CAST IRON ANODE STRING CONTAINING 36 - 1-1/8" X 9" SEGMENTS ON a 0' RADIUS, 4' OFF BOTTOM



NOTE:

ALL HAND HOLE COVER GASKETS TO BE REPLACED WITH BUTYL RUBBER

1 - EXISTING CONDUIT. REMOVE EXISTING WIRE AND REPLACE WITH 2 - #12-7 STRAND THHN WIRE

1 - EXISTING 18 VOLT 20 AMP MANUAL RECTIFIER HARCO NO. 5630

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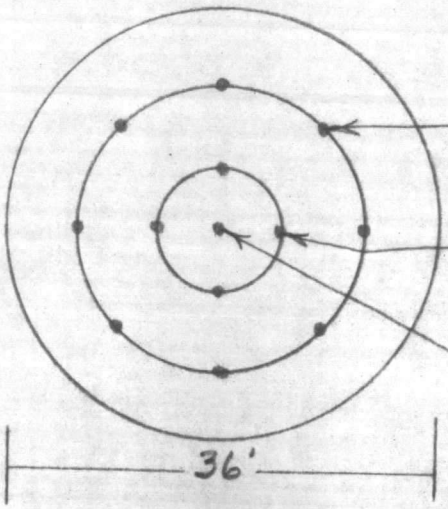
HARCO CORPORATION
Corrosion Engineering Division

CLEVELAND · ATLANTA · CHICAGO
HOUSTON · LOS ANGELES · NEWARK

CATHODIC PROTECTION
250,000 GALLON TANK NO. S-TT-40
TT
CAMP LEJEUNE, NORTH CAROLINA

AS BUILT

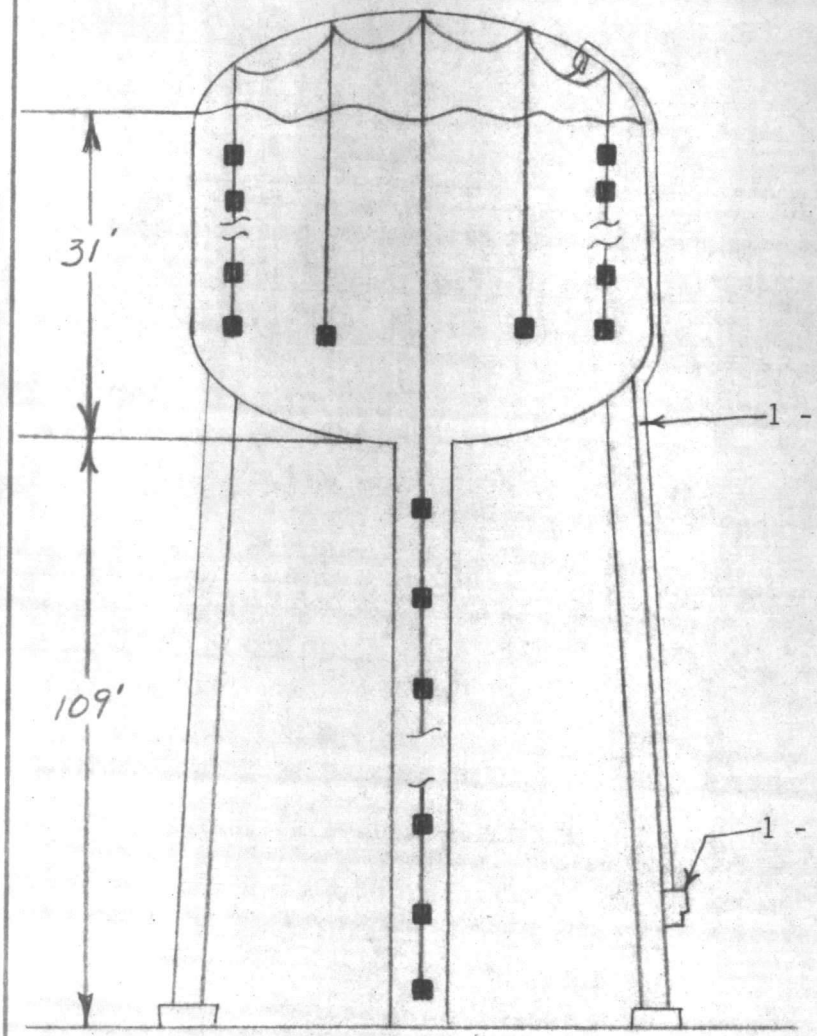
BY J.E.W.	DATE 8-27-80	NO. T-48844-11



8 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 8 - 1-1/8" X 9" SEGMENTS ON EXISTING RADIUS, 3' OFF BOTTOM

4 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 1 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

1 - NEW HIGH SILICON CAST IRON ANODE STRING CONTAINING 31 - 1-1/8" X 9" SEGMENTS ON A 0' RADIUS, 4' OFF BOTTOM



NOTE:

ALL HAND HOLE COVER GASKETS TO BE REPLACED WITH BUTYL RUBBER

1 - EXISTING CONDUIT. REMOVE EXISTING WIRE AND REPLACE WITH 2 - #12-7 STRAND THHN WIRE

1 - NEW GOODALL ELECTRIC 40 VOLT 20 AMP DUAL CIRCUIT MANUAL RECTIFIER CATALOG #CSAWSA 40-20. SYSTEM NEGATIVE MAY BE MADE AT OR NEAR RECTIFIER MOUNTING CHANNEL

EXISTING 115/60/1Ø CONNECT BY HARCO

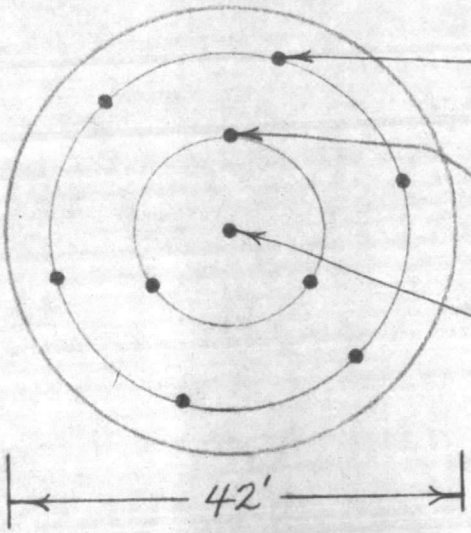
HARCO

HARCO CORPORATION
Corrosion Engineering Division

CLEVELAND · ATLANTA · CHICAGO
HOUSTON · LOS ANGELES · NEWARK

CATHODIC PROTECTION
200,000 GALLON TANK NO. S-MP-4004
MIDWAY PARK
CAMP LEJEUNE, NORTH CAROLINA
AS BUILT

BY: J.E.W.	DATE: 8-27-80	NO. T-48844-12



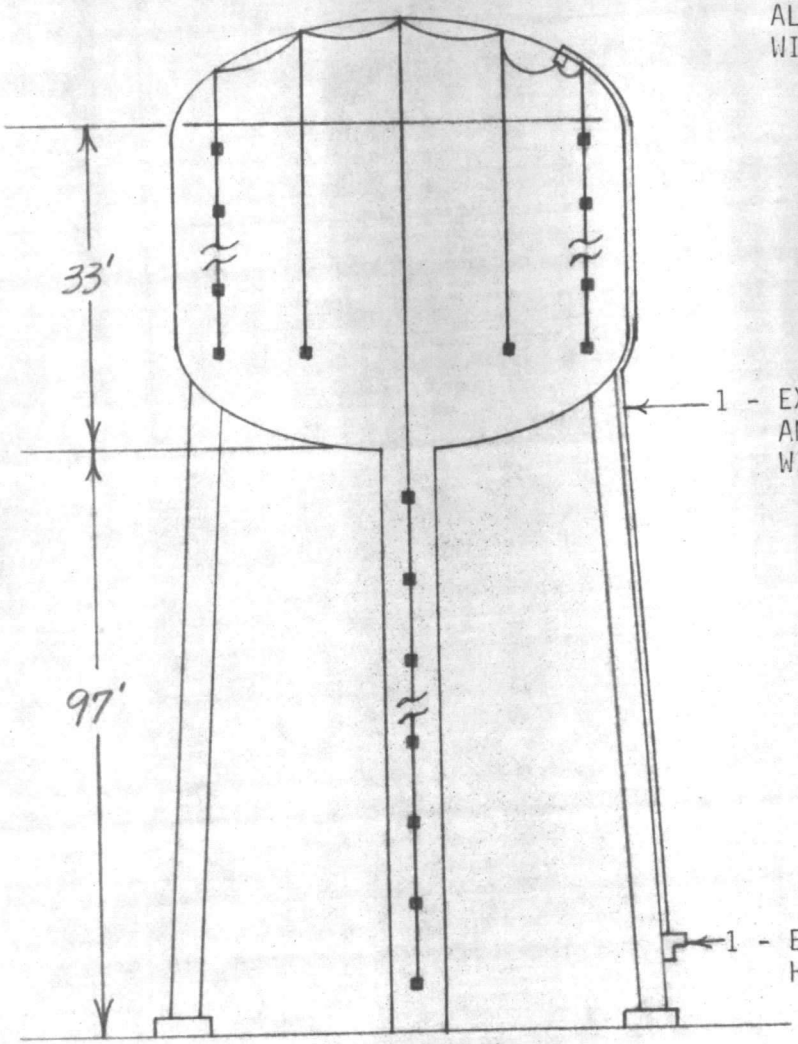
6 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 9 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

3 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 1 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

1 - NEW HIGH SILICON CAST IRON ANODE STRING CONTAINING 32 - 1/18" X 9" SEGMENTS ON A 0' RADIUS, 4' OFF BOTTOM

NOTE:

ALL HAND HOLE COVER GASKETS TO BE REPLACED WITH BUTYL RUBBER



1 - EXISTING CONDUIT. REMOVE EXISTING WIRE AND REPLACE WITH 2 - #12-7 STRAND THHN WIRE

1 - EXISTING 36 VOLT 20 AMP MANUAL RECTIFIER HARCO NO. 5201

HARCO

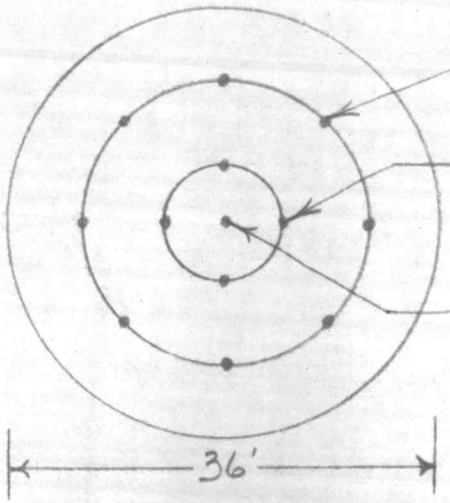
HARCO CORPORATION
Corrosion Engineering Division

CLEVELAND · ATLANTA · CHICAGO
HOUSTON · LOS ANGELES · NEWARK

CATHODIC PROTECTION
300,000 GALLON TANK NO. S-830
CAPEHART
CAMP LEJEUNE, NORTH CAROLINA

AS BUILT

BY: J.E.W.	DATE: 8-27-80	NO. T-48844-13



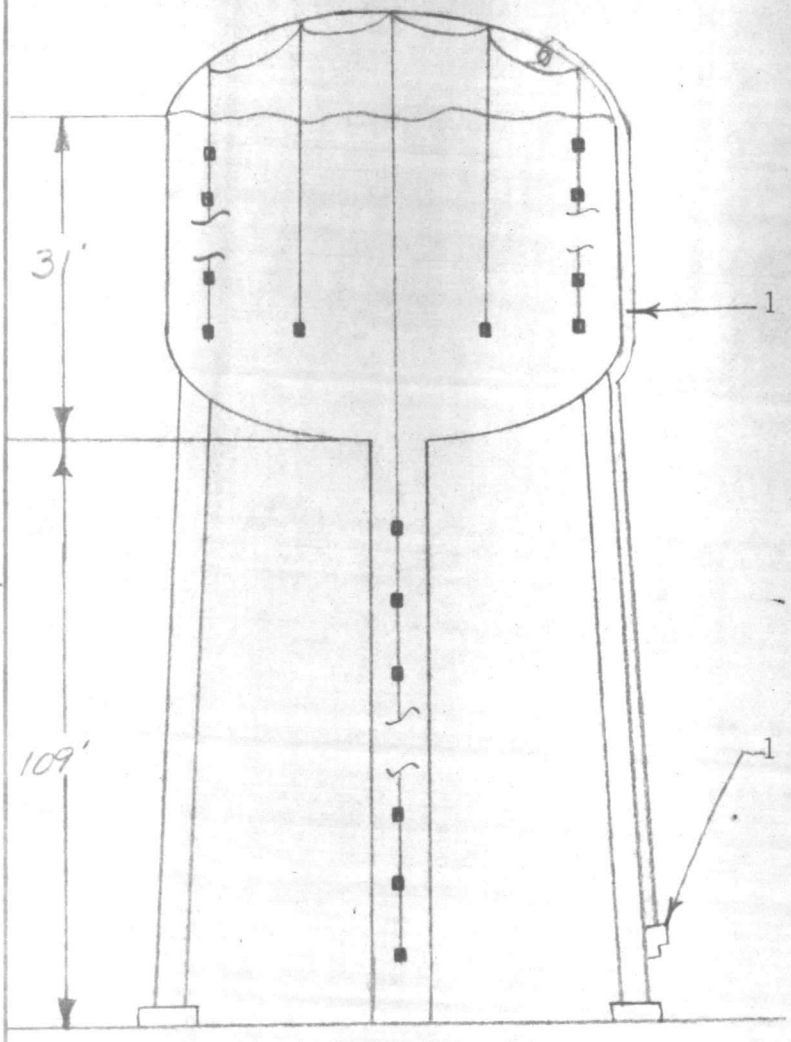
8 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 8 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

4 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 1 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

1 - NEW HIGH SILICON CAST IRON ANODE STRING CONTAINING 31 - 1-1/8" X 9" SEGMENTS ON A 0' RADIUS, 4' OFF BOTTOM

NOTE:

ALL HAND HOLE COVER GASKETS TO BE REPLACED WITH BUTYL RUBBER



1 - EXISTING CONDUIT. REMOVE EXISTING WIRE AND REPLACE WITH 2 - #12-7 STRAND THHN WIRE

1 - NEW GOODALL ELECTRIC 40 VOLT 20 AMP DUAL CIRCUIT MANUAL RECTIFIER CATALOG #CSAWSA 40-20. SYSTEM NEGATIVE MAY BE MADE AT OR NEAR RECTIFIER MOUNTING CHANNEL

EXISTING 115/60/1Ø CONNECT BY HARCO

HARCO

HARCO CORPORATION
Corrosion Engineering Division

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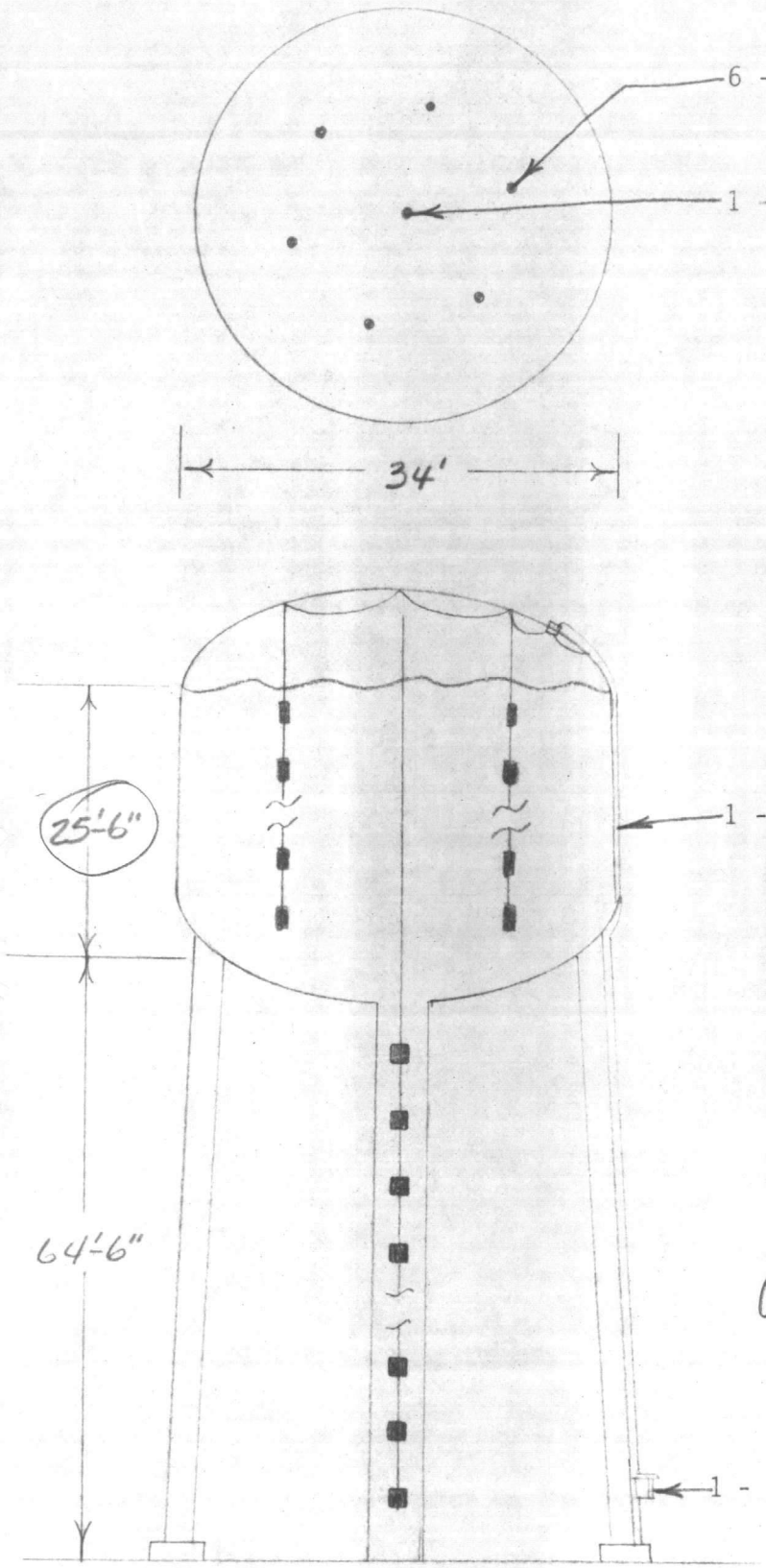
HOUSTON · LOS ANGELES · NEWARK

CATHODIC PROTECTION

200,000 GALLON TANK NO. S-2323
GOLF COURSE
CAMP LEJEUNE, NORTH CAROLINA

AS BUILT

BY: J.E.W.	DATE: 8-27-80	NO. T-48844-14



6 - NEW NIGH SILICON CAST IRON ANODE STRINGS CONTAINING 6 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

1 - NEW HIGH SILICON CAST IRON ANODE STRING CONTAINING 20 - 1-1/8" X 9" SEGMENTS ON A 0' RADIUS, 4' OFF BOTTOM

NOTE:

ALL HAND HOLE COVER GASKETS TO BE REPLACED WITH BUTYL RUBBER

1 - EXISTING CONDUIT. REMOVE EXISTING WIRE AND REPLACE WITH 2 - #12-7 STRNAD THHN WIRE

90.2

1 - EXISTING 18 VOLT 10 AMP MANUAL RECTIFIER HARCO NO. 12210

HARCO

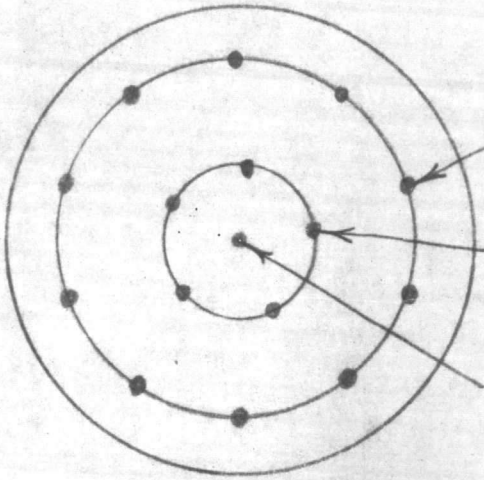
HARCO CORPORATION
Corrosion Engineering Division

CLEVELAND · ATLANTA · CHICAGO
HOUSTON · LOS ANGELES · NEWARK

CATHODIC PROTECTION
150,000 GALLON TANK NO. S-M-624
MONTFORD PLANT
CAMP LEJEUNE, NORTH CAROLINA

AS BUILT

BY: J.E.W.	DATE: 3-27-80	NO. T-48844-10



10 - NEW HIGH SILICON AST IRON ANODE STRINGS CONTINAING 8 - 1-1/8" X 9" SEGMENTS EACH ON EXISTING RADIUS, 3' OFF BOTTOM

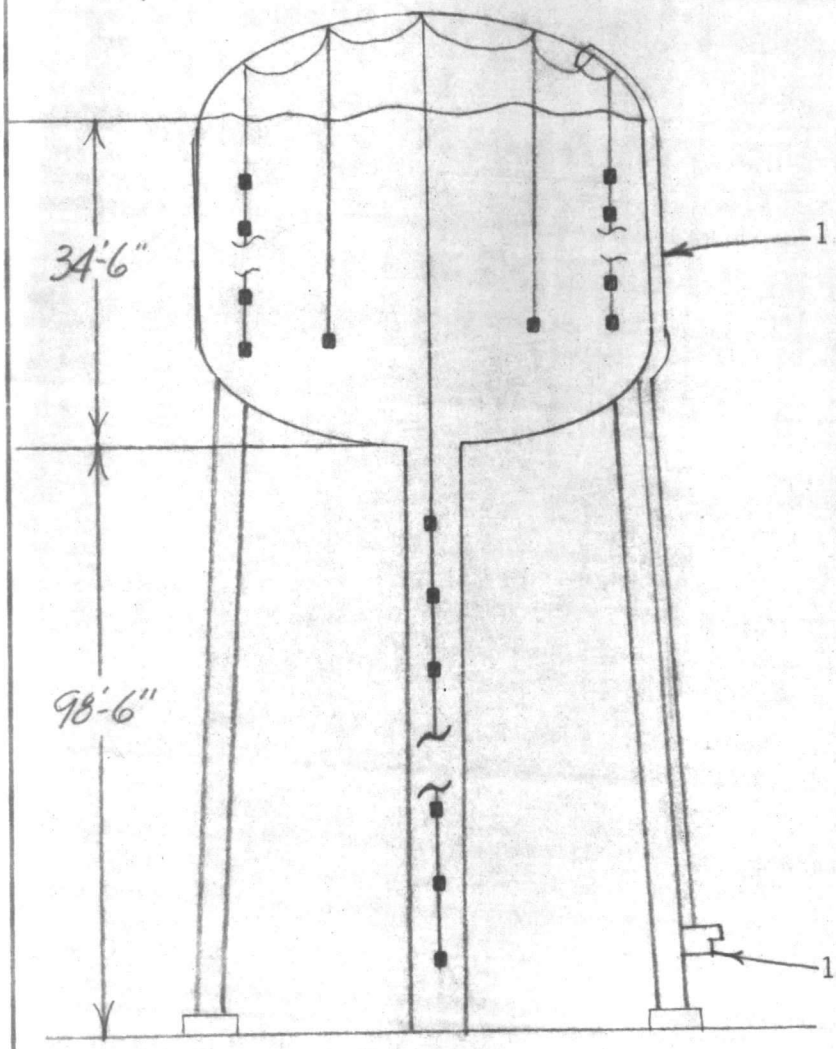
5 - NEW HIGH SILICON CAST IRON ANODE STRINGS CONTAINING 1 - 1-1/8" X 9" SEGMENTS ON EXISTING RADIUS, 3' OFF BOTTOM

1 - NEW HIGH SILICON CAST IRON ANDE STRING CONTAINING 31 - 1-1/8" X 9" SEGMENTS ON A 0' RADIUS, 4' OFF BOTTOM

42'

NOTE:

ALL HAND HOLE COVER GASKETS TO BE REPLACED WITH BUTYL RUBBER



1 - EXISTING CONDUIT. REMOVE EXISTING WIRE AND REPLACE WITH 2 - #12-7 STRAND THHN WIRE

1 - EXISTING 18 VOLT 20 AMP MANUAL RECTIFIER HARCO NO. 4108

HARCO

HARCO CORPORATION
Corrosion Engineering Division

CLEVELAND · ATLANTA · CHICAGO
HOUSTON · LOS ANGELES · NEWARK

CATHODIC PROTECTION
300,000 GALLON TANK NO. S-5
2nd AREA
CAMP LEJEUNE, NORTH CAROLINA

AS BUILT

BY: J.E.W.	DATE: 8-27-80	NO. T-48844-15

Harco Corporation
2567 PARK CENTRAL BOULEVARD
DECATUR, GEORGIA 30035 404/981-3150

WATER TANK WORK ORDER / CATHODIC PROTECTION SERVICE REPORT

For Camp Lejeune | Harco Job No. T48844 | Customer P.O. # N62470-79-B-2646
Jacksonville, N.C. | Contract Type | Contract Effective
S-1000 | Tank Type 300m gal. | Heated Yes ☐ No ☒
Industrial Area | Rectifier # 80C2863 | Controller Card No.

SERVICE CREW INSTRUCTIONS: Before and and after servicing system notify
Ens. Matt Mlekush 451-2581 919

1. Anodes ☐ Replace all anodes ☐ Inspect all anodes
2. Make other minor repairs required to provide effective cathodic protection.
3. Test and adjust equipment and provide the customer with a copy of results and operating instructions.
4. Evaluate repairs required that are outside the scope of this order and notify both the customer and Harco office.

ANODE CONFIGURATION:

	Type	Size
Ring 1	10 HiSi w/8 Sec.	
Ring 2	5 " w/1 Sec.	
Ring 3	1 " w/1 Sec.	
Ring 4		

FOR SERVICE CREW USE ONLY

	Condition	No. Inspected	No. Replaced
Ring 1		10	
Ring 2		5	
Ring 3		1	
Ring 4			

ESTIMATED JOB TIME /HRS.

SERVICE CREW COMPLETE THIS SECTION

Rectifier New | Reference Cells
Wiring New | Suspension New

SYSTEM FOUND OPERATING AT: D.C. Volts Off ; D.C. Amps #1 (Main) ____ , D.C. Amps #2 (Aux.) ____ ;
Potential Level ____ ; Set Point ____ ; Tap A-2 ; Water Level 90% ; Fuses Good ;

RESISTANCE READINGS: Bowl Ckt. ____ ; Riser Ckt. ____ ; Reference Ckt. ____ ;

SYSTEM LEFT OPERATING AT: D.C. Volts 5 D.C. Amps #1 (Main) 2.5A D.C. Amps #2 (Aux.) .6A
Energized Potential ____ Set Point ____ Natural Potential ____ Tap Setting A-4

POTENTIAL TEST RESULTS: Testing with high resistance V.M. and Harco Permacell

Location	Top	Natural	1.00	On	1.10	Instant Off	1.05
Location	Middle	Natural	.95	On	.98	Instant Off	.96
Location	Bottom	Natural	.90	On	1.00	Instant Off	.95

Repairs or replacements required for optimum performance not covered by this service.

CUSTOMER OPERATING INSTRUCTIONS: To insure continuous Cathodic Protection the rectifier should be inspected once a month with report cards completed and mailed.

☒ Manual—Rectifier should be adjusted to maintain Amps. #1 (Main) at 2.0 to 3.0 Amps; #2 (Aux.) at .5 to 1.0 Amps.

☐ Automatic—Rectifiers are not to be adjusted as they are pre-set. For optimum effect potential level meter should read ____ mv. ±25 mv.

DATE OF INSPECTION 5/4/81 **DATE** ____ **TIME** ____
SIGNED FOR HARCO BY J. Storm **SIGNED FOR CUSTOMER BY** ____

See back for additional comments. CUSTOMER PHONE # ____

HARCO Harco Corporation
2567 PARK CENTRAL BOULEVARD
DECATUR, GEORGIA 30035 404/981-3150

WATER TANK WORK ORDER / CATHODIC PROTECTION SERVICE REPORT

For Camp Lejeune
Jacksonville, N. C.
S-29
50 Area

Harco Job No. T-48844
Contract Type
Tank Type 300MG Elevated
Rectifier # 4106

Customer P.O. # N62470-79-B2646
Contract Effective
Heated Yes ☐ No ☒
Controller Card No.

SERVICE CREW INSTRUCTIONS: Before and and after servicing system notify
Ens. Matt L. Mlekush 451-2581

1. Anodes ☒ Replace all anodes ☐ Inspect all anodes
2. Make other minor repairs required to provide effective cathodic protection.
3. Test and adjust equipment and provide the customer with a copy of results and operating instructions.
4. Evaluate repairs required that are outside the scope of this order and notify both the customer and Harco office.

ANODE CONFIGURATION:

	Type	Size
Ring 1	10 Hi-Si W/8 Sections	
Ring 2	5 " W/1 Sections	
Ring 3	1 " W/31 Sections	
Ring 4		

FOR SERVICE CREW USE ONLY

	Condition	No. Inspected	No. Replaced
Ring 1	NEW	10	
Ring 2	New	5	
Ring 3	New	1	
Ring 4			

ESTIMATED JOB TIME /HRS.

SERVICE CREW COMPLETE THIS SECTION

Rectifier Existing-- Good
Reference Cells
Wiring New
Suspension New

SYSTEM FOUND OPERATING AT: D.C. Volts -- ;D.C. Amps #1 (Main) -- , D.C. Amps #2 (Aux.) -- ;
Potential Level ; Set Point ; Tap ; Water Level ; Fuses ;

RESISTANCE READINGS: Bowl Ckt. ; Riser Ckt. ; Reference Ckt. ;

SYSTEM LEFT OPERATING AT: D.C. Volts 3. D.C. Amps #1 (Main) 1.5 D.C. Amps #2 (Aux.) .5
Energized Potential Set Point Natural Potential Tap Setting B-5

POTENTIAL TEST RESULTS: Testing with high resistance V.M. and Harco Permacell

Location Bottom Natural -450 MV On -900 MV Instant Off
Location Middle Natural -450 MV On -1010 MV Instant Off
Location Top Natural -450 MV On -1250 MV Instant Off

Repairs or replacements required for optimum performance not covered by this service.
Replaced defective bowl ammeter

CUSTOMER OPERATING INSTRUCTIONS: To insure continuous Cathodic Protection the rectifier should be inspected once a month with report cards completed and mailed.

☒ Manual—Rectifier should be adjusted to maintain Amps. #1 (Main) at 1. to 2. Amps; #2 (Aux.) at .2 to .8 Amps.

☐ Automatic—Rectifiers are not to be adjusted as they are pre-set. For optimum effect potential level meter should read ____ mv. ±25 mv.

DATE OF INSPECTION July 21, 1981 **DATE** July 21, 1981 **TIME** 10:30 A.M.
SIGNED FOR HARCO BY Fred Motika **SIGNED FOR CUSTOMER BY**

See back for additional comments. CUSTOMER PHONE #

HARCO Harco Corporation
2567 PARK CENTRAL BOULEVARD
DECATUR, GEORGIA 30035 404/981-3150

WATER TANK WORK ORDER / CATHODIC PROTECTION SERVICE REPORT

For Camp Lejeune | Harco Job No. T48844 | Customer P.O. # N62470-79-B-2646
Jacksonville, N.C. | Contract Type _____ | Contract Effective _____
SFC-314 | Tank Type 300m gal. Elev. | Heated Yes ☐ No ☐
Force Troops | Rectifier # 7238 | Controller Card No. _____

SERVICE CREW INSTRUCTIONS: Before and and after servicing system notify _____
Ens. Matt L. Mlekush 451-2581

1. Anodes ☐ Replace all anodes ☐ Inspect all anodes
2. Make other minor repairs required to provide effective cathodic protection.
3. Test and adjust equipment and provide the customer with a copy of results and operating instructions.
4. Evaluate repairs required that are outside the scope of this order and notify both the customer and Harco office.

ANODE CONFIGURATION:

	Type	Size
Ring 1	8 HiSi w/6 Sec.	
Ring 2	4 " w/1 Sec.	
Ring 3	1 " w/31 Sec.	
Ring 4		

FOR SERVICE CREW USE ONLY

Condition	No. Inspected	No. Replaced
New	8	
"	4	
"	1	

ESTIMATED JOB TIME _____ /HRS.

SERVICE CREW COMPLETE THIS SECTION

Rectifier Good Condition | Reference Cells _____
Wiring New | Suspension New

SYSTEM FOUND OPERATING AT: D.C. Volts Off ; D.C. Amps #1 (Main) _____ , D.C. Amps #2 (Aux.) _____ ;
Potential Level _____ ; Set Point _____ ; Tap A-4 ; Water Level 90% ; Fuses Good ;

RESISTANCE READINGS: Bowl Ckt. _____ ; Riser Ckt. _____ ; Reference Ckt. _____ ;

SYSTEM LEFT OPERATING AT: D.C. Volts 7 D.C. Amps #1 (Main) 2A D.C. Amps #2 (Aux.) .8A
Energized Potential 110 Set Point _____ Natural Potential 80 Tap Setting A-5

POTENTIAL TEST RESULTS: Testing with high resistance V.M. and Harco Permacell

Location	Top	Natural	.85	On	1.10	Instant Off	.95
Location	Middle	Natural	.86	On	1.08	Instant Off	.90
Location	Bottom	Natural	.90	On	1.00	Instant Off	.95

Repairs or replacements required for optimum performance not covered by this service.

_____

CUSTOMER OPERATING INSTRUCTIONS: To insure continuous Cathodic Protection the rectifier should be inspected once a month with report cards completed and mailed.

☒ Manual—Rectifier should be adjusted to maintain Amps. #1 (Main) at 2.0 to 3.0 Amps; #2 (Aux.) at .5 to 1.0 Amps.

☐ Automatic—Rectifiers are not to be adjusted as they are pre-set. For optimum effect potential level meter should read _____ mv. ±25 mv.

DATE OF INSPECTION 5/4/81 **DATE** _____ **TIME** _____

SIGNED FOR HARCO BY J. Storm **SIGNED FOR CUSTOMER BY** _____

See back for additional comments. CUSTOMER PHONE # _____

Harco Corporation
2567 PARK CENTRAL BOULEVARD
DECATUR, GEORGIA 30035 404/981-3150

WATER TANK WORK ORDER / CATHODIC PROTECTION SERVICE REPORT

For Camp Lejeune
Jacksonville, N.C.
S-BB-25
Court House Bay

Harco Job No. T48844
Contract Type
Tank Type 100 m gal
Rectifier # 4104

Customer P.O. # N62470-79-B-2646
Contract Effective
Heated Yes ☐ No ☒
Controller Card No.

SERVICE CREW INSTRUCTIONS: Before and and after servicing system notify
Ens. Matt Mlekush 451-2581

1. Anodes ☐ Replace all anodes ☐ Inspect all anodes
2. Make other minor repairs required to provide effective cathodic protection.
3. Test and adjust equipment and provide the customer with a copy of results and operating instructions.
4. Evaluate repairs required that are outside the scope of this order and notify both the customer and Harco office.

ANODE CONFIGURATION:

	Type	Size
Ring 1	5 HiSi w/6 Sec.	
Ring 2	1 " w/31 Sec.	
Ring 3		
Ring 4		

FOR SERVICE CREW USE ONLY

Condition	No. Inspected	No. Replaced
	5	
	1	

ESTIMATED JOB TIME /HRS.

SERVICE CREW COMPLETE THIS SECTION

Rectifier Poor Condition
Reference Cells
Wiring New
Suspension New

SYSTEM FOUND OPERATING AT: D.C. Volts ; D.C. Amps #1 (Main) , D.C. Amps #2 (Aux.) ;
Potential Level ; Set Point ; Tap ; Water Level 100% ; Fuses Good ;

RESISTANCE READINGS: Bowl Ckt. ; Riser Ckt. ; Reference Ckt. ;

SYSTEM LEFT OPERATING AT: D.C. Volts 4.0 D.C. Amps #1 (Main) 2.1 D.C. Amps #2 (Aux.) .9
Energized Potential Set Point Natural Potential Tap Setting B-2

POTENTIAL TEST RESULTS: Testing with high resistance V.M. and Harco Permacell

Location	Top	Natural	.750	On	1.06	Instant Off	.810
Location	Middle	Natural	.730	On	.99	Instant Off	.780
Location	Bottom	Natural	.620	On	.94	Instant Off	.690

Repairs or replacements required for optimum performance not covered by this service.

CUSTOMER OPERATING INSTRUCTIONS: To insure continuous Cathodic Protection the rectifier should be inspected once a month with report cards completed and mailed.

☒ Manual—Rectifier should be adjusted to maintain Amps. #1 (Main) at 2.0 to 2.5 Amps; #2 (Aux.) at .7 to 1.2 Amps.

☐ Automatic—Rectifiers are not to be adjusted as they are pre-set. For optimum effect potential level meter should read _____ mv. ±25 mv.

DATE OF INSPECTION 4/30/81 **DATE** **TIME**

SIGNED FOR HARCO BY J. Storm **SIGNED FOR CUSTOMER BY**

See back for additional comments. CUSTOMER PHONE #

Harco Corporation
2567 PARK CENTRAL BOULEVARD
DECATUR, GEORGIA 30035 404/981-3150

WATER TANK WORK ORDER / CATHODIC PROTECTION SERVICE REPORT

For Camp Lejeune Jacksonville, N.C. Rifle Range Tank No. S-RR-44

Harco Job No. T48844
Contract Type New
Tank Type
Rectifier # 80C2835

Customer P.O. # N62470-79-B-2646
Contract Effective
Heated Yes ☐ No ☒
Controller Card No.

SERVICE CREW INSTRUCTIONS: Before and and after servicing system notify Ens. Matt Mlekush 451-2581

1. Anodes ☐ Replace all anodes ☐ Inspect all anodes
2. Make other minor repairs required to provide effective cathodic protection.
3. Test and adjust equipment and provide the customer with a copy of results and operating instructions.
4. Evaluate repairs required that are outside the scope of this order and notify both the customer and Harco office.

ANODE CONFIGURATION:

	Type	Size
Ring 1	5 Hi silicon iron	8 sect.
Ring 2	1 Hi silicon iron	34 sect.
Ring 3		
Ring 4		

FOR SERVICE CREW USE ONLY

Condition	No. Inspected	No. Replaced
New	5	
New	1	

ESTIMATED JOB TIME /HRS.

SERVICE CREW COMPLETE THIS SECTION

Rectifier New Reference Cells -
Wiring New Suspension New

SYSTEM FOUND OPERATING AT: D.C. Volts 11.0 ; D.C. Amps #1 (Main) 6.5 , D.C. Amps #2 (Aux.) 2.2 ;
Potential Level ; Set Point ; Tap ; Water Level 100% ; Fuses Good ;
RESISTANCE READINGS: Bowl Ckt. - ; Riser Ckt. - ; Reference Ckt. - ;
SYSTEM LEFT OPERATING AT: D.C. Volts 8.0 D.C. Amps #1 (Main) 6.1 D.C. Amps #2 (Aux.) 2.0
Energized Potential Set Point Natural Potential Tap Setting A-5

POTENTIAL TEST RESULTS: Testing with high resistance V.M. and Harco Permacell

Location	Top	Natural	.640	On	1.15	Instant Off	.800
Location	Middle	Natural	.610	On	1.03	Instant Off	.750
Location	Bottom	Natural	.600	On	.96	Instant Off	.710

Repairs or replacements required for optimum performance not covered by this service.

CUSTOMER OPERATING INSTRUCTIONS: To insure continuous Cathodic Protection the rectifier should be inspected once a month with report cards completed and mailed.

☒ Manual—Rectifier should be adjusted to maintain Amps. #1 (Main) at 6.0 to 7.0 Amps; #2 (Aux.) at 2.0 to 2.5 Amps.

☐ Automatic—Rectifiers are not to be adjusted as they are pre-set. For optimum effect potential level meter should read ____ mv. ±25 mv.

DATE OF INSPECTION 4/30/81 **DATE** **TIME**

SIGNED FOR HARCO BY J. Storm **SIGNED FOR CUSTOMER BY**

See back for additional comments. CUSTOMER PHONE #

HARCO Harco Corporation
2567 PARK CENTRAL BOULEVARD
DECATUR, GEORGIA 30035 404/981-3150

WATER TANK WORK ORDER / CATHODIC PROTECTION SERVICE REPORT

For Camp Lejeune
Jacksonville, N.C.
Air Station-White St.
Tank No. 4130

Harco Job No. T48844
Contract Type
Tank Type 350 mg
Rectifier # 9339

Customer P.O. # N62470-79-B-2646
Contract Effective
Heated Yes ☐ No ☐
Controller Card No.

SERVICE CREW INSTRUCTIONS: Before and and after servicing system notify Ens. Matt Mlekush 451-2581

1. Anodes ☐ Replace all anodes ☐ Inspect all anodes
2. Make other minor repairs required to provide effective cathodic protection.
3. Test and adjust equipment and provide the customer with a copy of results and operating instructions.
4. Evaluate repairs required that are outside the scope of this order and notify both the customer and Harco office.

ANODE CONFIGURATION:

	Type	Size
Ring 1	Hi silicon iron	8 sect.
Ring 2	" " "	1 sect.
Ring 3	" " "	36 sect.
Ring 4		

FOR SERVICE CREW USE ONLY

	Condition	No. Inspected	No. Replaced
Ring 1	New	8	
Ring 2	New	4	
Ring 3	New	1	
Ring 4			

ESTIMATED JOB TIME /HRS.

SERVICE CREW COMPLETE THIS SECTION

Rectifier Rebuilt
Reference Cells -
Wiring New
Suspension New

SYSTEM FOUND OPERATING AT: D.C. Volts Off ; D.C. Amps #1 (Main) ____ , D.C. Amps #2 (Aux.) ____ ;
Potential Level ____ ; Set Point ____ ; Tap ____ ; Water Level ____ ; Fuses ____ ;

RESISTANCE READINGS: Bowl Ckt. ____ ; Riser Ckt. ____ ; Reference Ckt. ____ ;

SYSTEM LEFT OPERATING AT: D.C. Volts 12.0 D.C. Amps #1 (Main) 7.5 D.C. Amps #2 (Aux.) 1.5
Energized Potential ____ Set Point - Natural Potential .600 Tap Setting A-5

POTENTIAL TEST RESULTS: Testing with high resistance V.M. and Harco Permacell

Location	Top	Natural	.600	On	1.18	Instant Off	.880
Location	Middle	Natural	.600	On	1.20	Instant Off	.890
Location	Bottom	Natural	.610	On	1.10	Instant Off	.900

Repairs or replacements required for optimum performance not covered by this service.

CUSTOMER OPERATING INSTRUCTIONS: To insure continuous Cathodic Protection the rectifier should be inspected once a month with report cards completed and mailed.

☒ Manual—Rectifier should be adjusted to maintain Amps. #1 (Main) at .7 to .8 Amps; #2 (Aux.) at 1.0 to 2.0 Amps.

☐ Automatic—Rectifiers are not to be adjusted as they are pre-set. For optimum effect potential level meter should read ____ mv. ±25 mv.

DATE OF INSPECTION 5/3/81 **DATE** ____ **TIME** ____

SIGNED FOR HARCO BY J. Storm **SIGNED FOR CUSTOMER BY** ____

See back for additional comments. CUSTOMER PHONE # ____

Harco Corporation
2567 PARK CENTRAL BOULEVARD
DECATUR, GEORGIA 30035 404/981-3150

WATER TANK WORK ORDER / CATHODIC PROTECTION SERVICE REPORT

For Camp Lejeune
Jacksonville, N.C.
Campbell Street
Tank No. 310

Harco Job No. T48844
Contract Type
Tank Type 300 m. gal
Rectifier # 81C1216

Customer P.O. # N62470-79-B-2646
Contract Effective
Heated Yes ☐ No ☐
Controller Card No.

SERVICE CREW INSTRUCTIONS: Before and and after servicing system notify
Ens. Matt Mlekush 451-2581

1. Anodes ☐ Replace all anodes ☐ Inspect all anodes
2. Make other minor repairs required to provide effective cathodic protection.
3. Test and adjust equipment and provide the customer with a copy of results and operating instructions.
4. Evaluate repairs required that are outside the scope of this order and notify both the customer and Harco office.

ANODE CONFIGURATION:

	Type	Size
Ring 1	Hi Silicon iron	8 sect.
Ring 2	" " "	1 sect.
Ring 3	" " "	36 sect.
Ring 4		

FOR SERVICE CREW USE ONLY

Condition	No. Inspected	No. Replaced
New	8	
New	4	
New	1	

ESTIMATED JOB TIME /HRS.

SERVICE CREW COMPLETE THIS SECTION

Rectifier New mount
Wiring New
Reference Cells -
Suspension New

SYSTEM FOUND OPERATING AT: D.C. Volts off ; D.C. Amps #1 (Main) ____ , D.C. Amps #2 (Aux.) ____ ;
Potential Level ____ ; Set Point ____ ; Tap ____ ; Water Level 100% ; Fuses Good ;

RESISTANCE READINGS: Bowl Ckt. - ; Riser Ckt. - ; Reference Ckt. - ;

SYSTEM LEFT OPERATING AT: D.C. Volts 16.0 D.C. Amps #1 (Main) 9.0 D.C. Amps #2 (Aux.) 2.0
Energized Potential ____ Set Point ____ Natural Potential ____ Tap Setting A-5

POTENTIAL TEST RESULTS: Testing with high resistance V.M. and Harco Permacell

Location	Top	Natural	.620	On	1.11	Instant Off .88
Location	Middle	Natural	.630	On	1.94	Instant Off .84
Location	Bottom	Natural	.600	On	.92	Instant Off .82

Repairs or replacements required for optimum performance not covered by this service.

CUSTOMER OPERATING INSTRUCTIONS: To insure continuous Cathodic Protection the rectifier should be inspected once a month with report cards completed and mailed.

☒ Manual—Rectifier should be adjusted to maintain Amps. #1 (Main) at 9.0 to 10.0 Amps; #2 (Aux.) at 2.0 to 2.5 Amps.

☐ Automatic—Rectifiers are not to be adjusted as they are pre-set. For optimum effect potential level meter should read ____ mv. ±25 mv.

DATE OF INSPECTION 5/3/81 **DATE** ____ **TIME** ____

SIGNED FOR HARCO BY J. Storm **SIGNED FOR CUSTOMER BY** ____

See back for additional comments. CUSTOMER PHONE # ____

Harco Corporation
2567 PARK CENTRAL BOULEVARD
DECATUR, GEORGIA 30035 404/981-3150

WATER TANK WORK ORDER / CATHODIC PROTECTION SERVICE REPORT

For Camp Lejeune
Jacksonville, N. C.
TC Geiger South
Tank No. S-TC-1070

Harco Job No. T48844
Contract Type
Tank Type 100 m. gal
Rectifier # 81C1215

Customer P.O. # N62470-79-B-2646
Contract Effective
Heated Yes ☐ No ☐
Controller Card No.

SERVICE CREW INSTRUCTIONS: Before and and after servicing system notify 60528A
Ens. Matt Mlekush

1. Anodes ☐ Replace all anodes ☐ Inspect all anodes
2. Make other minor repairs required to provide effective cathodic protection.
3. Test and adjust equipment and provide the customer with a copy of results and operating instructions.
4. Evaluate repairs required that are outside the scope of this order and notify both the customer and Harco office.

ANODE CONFIGURATION:

	Type	Size
Ring 1	Hi Silicon iron	6 sect.
Ring 2	" " "	39 sect.
Ring 3		
Ring 4		

FOR SERVICE CREW USE ONLY

Condition	No. Inspected	No. Replaced
New	5	
New	1	

ESTIMATED JOB TIME /HRS.

SERVICE CREW COMPLETE THIS SECTION

Rectifier New Reference Cells -
Wiring New Suspension New

SYSTEM FOUND OPERATING AT: D.C. Volts off ; D.C. Amps #1 (Main) ____ , D.C. Amps #2 (Aux.) ____ ;
Potential Level ____ ; Set Point off ; Tap ____ ; Water Level ____ ; Fuses ____ ;

RESISTANCE READINGS: Bowl Ckt. - ; Riser Ckt. - ; Reference Ckt. - ;

SYSTEM LEFT OPERATING AT: D.C. Volts 4.5 D.C. Amps #1 (Main) 2.5 D.C. Amps #2 (Aux.) 1.5
Energized Potential ____ Set Point ____ Natural Potential ____ Tap Setting ____

POTENTIAL TEST RESULTS: Testing with high resistance V.M. and Harco Permacell

Location	Top	Natural	.600	On	1.15	Instant Off	.94
Location	Middle	Natural	.610	On	1.00	Instant Off	.85
Location	Bottom	Natural	.600	On	.92	Instant Off	.70

Repairs or replacements required for optimum performance not covered by this service.

CUSTOMER OPERATING INSTRUCTIONS: To insure continuous Cathodic Protection the rectifier should be inspected once a month with report cards completed and mailed.

☒ Manual—Rectifier should be adjusted to maintain Amps. #1 (Main) at 2.0 to 3.0 Amps; #2 (Aux.) at 1.5 to 2.0 Amps.

☐ Automatic—Rectifiers are not to be adjusted as they are pre-set. For optimum effect potential level meter should read ____ mv. ±25 mv.

DATE OF INSPECTION 5/4/81 **DATE** ____ **TIME** ____

SIGNED FOR HARCO BY J. Storm **SIGNED FOR CUSTOMER BY** ____

See back for additional comments. CUSTOMER PHONE # ____

HARCO Harco Corporation
2567 PARK CENTRAL BOULEVARD
DECATUR, GEORGIA 30035 404/981-3150

WATER TANK WORK ORDER / CATHODIC PROTECTION SERVICE REPORT

For Camp Lejeune
Jacksonville, N.C.
Geiger North
Tank No. S-TC-606

Harco Job No. T48844
Contract Type
Tank Type 100 m gal
Rectifier # 7236

Customer P.O. # N62470-79-B-2646
Contract Effective
Heated Yes ☐ No ☒
Controller Card No.

SERVICE CREW INSTRUCTIONS: Before and and after servicing system notify Ens Matt Mlekush 451-2581

1. Anodes ☐ Replace all anodes ☐ Inspect all anodes
2. Make other minor repairs required to provide effective cathodic protection.
3. Test and adjust equipment and provide the customer with a copy of results and operating instructions.
4. Evaluate repairs required that are outside the scope of this order and notify both the customer and Harco office.

ANODE CONFIGURATION:

	Type	Size
Ring 1	Hi Silicon iron	6 sects.
Ring 2	" " "	39 sect.
Ring 3		
Ring 4		

FOR SERVICE CREW USE ONLY

	Condition	No. Inspected	No. Replaced
	New	5	
	New	1	

ESTIMATED JOB TIME /HRS.

SERVICE CREW COMPLETE THIS SECTION

Rectifier O.K. Reference Cells -
Wiring New Suspension New

SYSTEM FOUND OPERATING AT: D.C. Volts off ; D.C. Amps #1 (Main) ____ , D.C. Amps #2 (Aux.) ____ ;
Potential Level ____ ; Set Point ____ ; Tap ____ ; Water Level ____ ; Fuses ____ ;

RESISTANCE READINGS: Bowl Ckt. - ; Riser Ckt. - ; Reference Ckt. - ;

SYSTEM LEFT OPERATING AT: D.C. Volts 1.5 D.C. Amps #1 (Main) 1.0 D.C. Amps #2 (Aux.) .5 A-3
Energized Potential ____ Set Point ____ Natural Potential ____ Tap Setting ____

POTENTIAL TEST RESULTS: Testing with high resistance V.M. and Harco Permacell

Location	Top	Natural	.80	On	1.38	Instant Off	1.01
Location	Middle	Natural	.76	On	1.27	Instant Off	1.04
Location	Bottom	Natural	.72	On	1.19	Instant Off	.98

Repairs or replacements required for optimum performance not covered by this service.

CUSTOMER OPERATING INSTRUCTIONS: To insure continuous Cathodic Protection the rectifier should be inspected once a month with report cards completed and mailed.

☒ Manual—Rectifier should be adjusted to maintain Amps. #1 (Main) at 1.0 to 1.5 Amps; #2 (Aux.) at .5 to 1.0 Amps.

☐ Automatic—Rectifiers are not to be adjusted as they are pre-set. For optimum effect potential level meter should read ____ mv. ±25 mv.

DATE OF INSPECTION 5/4/81 **DATE** ____ **TIME** ____

SIGNED FOR HARCO BY J. Storm **SIGNED FOR CUSTOMER BY** ____

See back for additional comments. CUSTOMER PHONE # ____

HARCO Harco Corporation
2567 PARK CENTRAL BOULEVARD
DECATUR, GEORGIA 30035 404/981-3150

WATER TANK WORK ORDER / CATHODIC PROTECTION SERVICE REPORT

For Camp Lejeune
Jacksonville, N.C.
Montford Pt.
S-M-624

Harco Job No. T48844
Contract Type
Tank Type 100m gal
Rectifier # 12210

Customer P.O. # N62470-79-B-2646
Contract Effective
Heated Yes ☐ No ☐
Controller Card No.

SERVICE CREW INSTRUCTIONS: Before and and after servicing system notify
Matt Mlekush 451-2581

1. Anodes ☐ Replace all anodes ☐ Inspect all anodes
2. Make other minor repairs required to provide effective cathodic protection.
3. Test and adjust equipment and provide the customer with a copy of results and operating instructions.
4. Evaluate repairs required that are outside the scope of this order and notify both the customer and Harco office.

ANODE CONFIGURATION:

	Type	Size
Ring 1	6 HiSi w/6 Sec,	
Ring 2	1 HiSi w/20 Sec.	
Ring 3		
Ring 4		

FOR SERVICE CREW USE ONLY

Condition	No. Inspected	No. Replaced
New	6	
"	1	

ESTIMATED JOB TIME /HRS.

SERVICE CREW COMPLETE THIS SECTION

Rectifier Good condition
Reference Cells
Wiring New
Suspension New

SYSTEM FOUND OPERATING AT: D.C. Volts Off ; D.C. Amps #1 (Main) , D.C. Amps #2 (Aux.) ;
Potential Level ; Set Point ; Tap ; Water Level ; Fuses ;

RESISTANCE READINGS: Bowl Ckt. ; Riser Ckt. ; Reference Ckt. ;

SYSTEM LEFT OPERATING AT: D.C. Volts 3.5 D.C. Amps #1 (Main) 2.5 D.C. Amps #2 (Aux.) 1.0
Energized Potential Set Point Natural Potential Tap Setting A-4

POTENTIAL TEST RESULTS: Testing with high resistance V.M. and Harco Permacell

Location	Top	Natural	.800	On	1.20	Instant Off	.95
Location	Middle	Natural	.780	On	1.48	Instant Off	.90
Location	Bottom	Natural	.750	On	1.11	Instant Off	.800

Repairs or replacements required for optimum performance not covered by this service.

CUSTOMER OPERATING INSTRUCTIONS: To insure continuous Cathodic Protection the rectifier should be inspected once a month with report cards completed and mailed.

☒ Manual—Rectifier should be adjusted to maintain Amps. #1 (Main) at 2.0 to 3.0 Amps; #2 (Aux.) at 1.0 to 1.5 Amps.

☐ Automatic—Rectifiers are not to be adjusted as they are pre-set. For optimum effect potential level meter should read ____ mv. ±25 mv.

DATE OF INSPECTION 5/3/81 **DATE** **TIME**

SIGNED FOR HARCO BY J. Storm **SIGNED FOR CUSTOMER BY**

See back for additional comments. CUSTOMER PHONE #

HARCO Harco Corporation
2567 PARK CENTRAL BOULEVARD
DECATUR, GEORGIA 30035 404/981-3150

WATER TANK WORK ORDER / CATHODIC PROTECTION SERVICE REPORT

For Camp Lejeune
Jacksonville, N.C.
S-TT-40
Terrawa Terrace

Harco Job No. T48844
Contract Type
Tank Type 350m gal
Rectifier # 5630

Customer P.O. # N62470-79-B-2646
Contract Effective
Heated Yes ☐ No ☒
Controller Card No.

SERVICE CREW INSTRUCTIONS: Before and and after servicing system notify
Ens. Matt Mlekush

1. Anodes ☐ Replace all anodes ☐ Inspect all anodes
2. Make other minor repairs required to provide effective cathodic protection.
3. Test and adjust equipment and provide the customer with a copy of results and operating instructions.
4. Evaluate repairs required that are outside the scope of this order and notify both the customer and Harco office.

ANODE CONFIGURATION:

	Type	Size
Ring 1	8 HiSi w/8 Sec.	
Ring 2	4 HiSi w/1 Sec.	
Ring 3	1 HiSi w/36 Sec.	
Ring 4		

FOR SERVICE CREW USE ONLY

Condition	No. Inspected	No. Replaced
New	8	
New	4	
New	1	

ESTIMATED JOB TIME /HRS.

SERVICE CREW COMPLETE THIS SECTION

Rectifier Rebuilt
Wiring New
Reference Cells
Suspension New

SYSTEM FOUND OPERATING AT: D.C. Volts 5.0; D.C. Amps #1 (Main) 2.8, D.C. Amps #2 (Aux.) 1.1;
Potential Level ; Set Point ; Tap ; Water Level ; Fuses ;

RESISTANCE READINGS: Bowl Ckt. ; Riser Ckt. ; Reference Ckt. ;

SYSTEM LEFT OPERATING AT: D.C. Volts 2.7 D.C. Amps #1 (Main) 2.5 D.C. Amps #2 (Aux.) .8
Energized Potential Set Point Natural Potential Tap Setting A-4

POTENTIAL TEST RESULTS: Testing with high resistance V.M. and Harco Permacell

Location	Top	Natural	.940	On	1.18	Instant Off	.98
Location	Middle	Natural	.910	On	1.10	Instant Off	.92
Location	Bottom	Natural	.800	On	.94	Instant Off	.85

Repairs or replacements required for optimum performance not covered by this service.

CUSTOMER OPERATING INSTRUCTIONS: To insure continuous Cathodic Protection the rectifier should be inspected once a month with report cards completed and mailed.

☑ Manual—Rectifier should be adjusted to maintain Amps. #1 (Main) at 2.0 to 3.0 Amps; #2 (Aux.) at .5 to 1.0 Amps.

☐ Automatic—Rectifiers are not to be adjusted as they are pre-set. For optimum effect potential level meter should read ____ mv. ±25 mv.

DATE OF INSPECTION 5/4/81 **DATE** **TIME**

SIGNED FOR HARCO BY J. Storm **SIGNED FOR CUSTOMER BY**

See back for additional comments. CUSTOMER PHONE #

Harco Corporation
2567 PARK CENTRAL BOULEVARD
DECATUR, GEORGIA 30035 404/981-3150

WATER TANK WORK ORDER / CATHODIC PROTECTION SERVICE REPORT

For Camp Lejeune
Jacksonville, N.C.
Midway Park
Tank No. S-MP-4004

Harco Job No. T48844
Contract Type
Tank Type
Rectifier # 80C2834

Customer P.O. # N62470-79-B-2646
Contract Effective
Heated Yes ☐ No ☒
Controller Card No.

SERVICE CREW INSTRUCTIONS: Before and and after servicing system notify Ens. Matt Mlekush

1. Anodes ☐ Replace all anodes ☐ Inspect all anodes
2. Make other minor repairs required to provide effective cathodic protection.
3. Test and adjust equipment and provide the customer with a copy of results and operating instructions.
4. Evaluate repairs required that are outside the scope of this order and notify both the customer and Harco office.

ANODE CONFIGURATION:

	Type	Size
Ring 1	Hi Silicon iron	8
Ring 2	" " "	4
Ring 3	" " "	1
Ring 4		

FOR SERVICE CREW USE ONLY

	Condition	No. Inspected	No. Replaced
Ring 1	New	8	
Ring 2	New	4	
Ring 3	New	1	
Ring 4			

ESTIMATED JOB TIME /HRS.

SERVICE CREW COMPLETE THIS SECTION

Rectifier New Reference Cells -
Wiring New Suspension New

SYSTEM FOUND OPERATING AT: D.C. Volts 2.0 ;D.C. Amps #1 (Main) 1.0 , D.C. Amps #2 (Aux.) .5 ;
Potential Level ____; Set Point ____; Tap ____; Water Level ____; Fuses Good ;

RESISTANCE READINGS: Bowl Ckt. ____; Riser Ckt. ____; Reference Ckt. ____ ;

SYSTEM LEFT OPERATING AT: D.C. Volts 7.0 D.C. Amps #1 (Main) 6.0 D.C. Amps #2 (Aux.) 2.2
Energized Potential ____ Set Point ____ Natural Potential ____ Tap Setting A-5

POTENTIAL TEST RESULTS: Testing with high resistance V.M. and Harco Permacell

Location	Top	Natural	.600	On	1.22	Instant Off	.96
Location	Middle	Natural	.630	On	1.10	Instant Off	.840
Location	Bottom	Natural	.700	On	.900	Instant Off	.780

Repairs or replacements required for optimum performance not covered by this service.

CUSTOMER OPERATING INSTRUCTIONS: To insure continuous Cathodic Protection the rectifier should be inspected once a month with report cards completed and mailed.

☒ Manual—Rectifier should be adjusted to maintain Amps. #1 (Main) at 6.0 to 7.0 Amps; #2 (Aux.) at 2.0 to 2.5 Amps.

☐ Automatic—Rectifiers are not to be adjusted as they are pre-set. For optimum effect potential level meter should read ____mv. ±25 mv.

DATE OF INSPECTION 5/4/81 **DATE** ____ **TIME** ____

SIGNED FOR HARCO BY J. Storm **SIGNED FOR CUSTOMER BY** ____

See back for additional comments. CUSTOMER PHONE # ____

HARCO Harco Corporation
2567 PARK CENTRAL BOULEVARD
DECATUR, GEORGIA 30035 404/981-3150

WATER TANK WORK ORDER / CATHODIC PROTECTION SERVICE REPORT

For Camp Lejeune
Jacksonville, N.C.
Tank No. S-830
Capehart

Harco Job No. T48844
Contract Type
Tank Type
Rectifier # 5201

Customer P.O. # N62470-79-B-2646
Contract Effective
Heated Yes ☐ No ☐
Controller Card No.

SERVICE CREW INSTRUCTIONS: Before and and after servicing system notify Ens. Matt Mlekush

1. Anodes ☐ Replace all anodes ☐ Inspect all anodes
2. Make other minor repairs required to provide effective cathodic protection.
3. Test and adjust equipment and provide the customer with a copy of results and operating instructions.
4. Evaluate repairs required that are outside the scope of this order and notify both the customer and Harco office.

ANODE CONFIGURATION:

	Type	Size
Ring 1	Hi silicon iron	8 6 sect.
Ring 2	" " "	4 1 sect.
Ring 3	" " "	1 36 sect.
Ring 4		

FOR SERVICE CREW USE ONLY

Condition	No. Inspected	No. Replaced
New	8	
"	4	
"	1	

ESTIMATED JOB TIME /HRS.

SERVICE CREW COMPLETE THIS SECTION

Rectifier Good — Reference Cells -
Wiring New — Suspension New

SYSTEM FOUND OPERATING AT: D.C. Volts ___ ;D.C. Amps #1 (Main) ___ , D.C. Amps #2 (Aux.) ___ ;
Potential Level ___ ; Set Point ___ ; Tap A-4 ; Water Level ___ ; Fuses ___ ;

RESISTANCE READINGS: Bowl Ckt. ___ ; Riser Ckt. ___ ; Reference Ckt. ___ ;

SYSTEM LEFT OPERATING AT: D.C. Volts 14.0 D.C. Amps #1 (Main) 5.0 D.C. Amps #2 (Aux.) 2.8
Energized Potential ___ Set Point ___ Natural Potential ___ Tap Setting B-5

POTENTIAL TEST RESULTS: Testing with high resistance V.M. and Harco Permacell

Location	Top	Natural	600	On	950	Instant Off 700
Location	Middle	Natural	.610	On	.920	Instant Off .680
Location	Bottom	Natural	.670	On	900	Instant Off .690

Repairs or replacements required for optimum performance not covered by this service.

CUSTOMER OPERATING INSTRUCTIONS: To insure continuous Cathodic Protection the rectifier should be inspected once a month with report cards completed and mailed.

☒ Manual—Rectifier should be adjusted to maintain Amps. #1 (Main) at 4.5 to 5.5 Amps; #2 (Aux.) at 2.5 to 3.0 Amps.

☐ Automatic—Rectifiers are not to be adjusted as they are pre-set. For optimum effect potential level meter should read ___ mv. ±25 mv.

DATE OF INSPECTION 5/4/81 **DATE** ___ **TIME** ___

SIGNED FOR HARCO BY J. Storm **SIGNED FOR CUSTOMER BY** ___

See back for additional comments. CUSTOMER PHONE # ___

HARCO Harco Corporation
2567 PARK CENTRAL BOULEVARD
DECATUR, GEORGIA 30035 404/981-3150

WATER TANK WORK ORDER / CATHODIC PROTECTION SERVICE REPORT

For Camp Lejeune
Jacksonville, N.E.
Tank No. S-2323
Golf Course

Harco Job No. T48844
Contract Type
Tank Type 150 M gal
Rectifier # 80C2833

Customer P.O. # N62470-79-B-2646
Contract Effective
Heated Yes ☐ No ☐
Controller Card No.

SERVICE CREW INSTRUCTIONS: Before and and after servicing system notify Ens. Matt Mlekush

1. Anodes ☐ Replace all anodes ☐ Inspect all anodes
2. Make other minor repairs required to provide effective cathodic protection.
3. Test and adjust equipment and provide the customer with a copy of results and operating instructions.
4. Evaluate repairs required that are outside the scope of this order and notify both the customer and Harco office.

ANODE CONFIGURATION:

	Type	Size
Ring 1	Hi silicon iron	8 sect.
Ring 2	" " "	1 sect.
Ring 3	" " "	36 sect.
Ring 4		

FOR SERVICE CREW USE ONLY

Condition	No. Inspected	No. Replaced
New	8	
"	4	
"	1	

ESTIMATED JOB TIME /HRS.

SERVICE CREW COMPLETE THIS SECTION

Rectifier New — Reference Cells -
Wiring New — Suspension New

SYSTEM FOUND OPERATING AT: D.C. Volts ____ ;D.C. Amps #1 (Main) ____ , D.C. Amps #2 (Aux.) ____ ;
Potential Level ____ ; Set Point ____ ; Tap ____ ; Water Level 100% ; Fuses New ;

RESISTANCE READINGS: Bowl Ckt. ____ ; Riser Ckt. ____ ; Reference Ckt. ____ ;

SYSTEM LEFT OPERATING AT: D.C. Volts 4.0 D.C. Amps #1 (Main) 1.5 D.C. Amps #2 (Aux.) .5
Energized Potential ____ Set Point ____ Natural Potential ____ Tap Setting A-3

POTENTIAL TEST RESULTS: Testing with high resistance V.M. and Harco Permacell

Location	Top	Natural	.78	On	1.16	Instant Off .95
Location	Middle	Natural	.95	On	1.05	Instant Off .96
Location	Bottom	Natural	.98	On	1.07	Instant Off 1.00

Repairs or replacements required for optimum performance not covered by this service.

CUSTOMER OPERATING INSTRUCTIONS: To insure continuous Cathodic Protection the rectifier should be inspected once a month with report cards completed and mailed.

☒ Manual—Rectifier should be adjusted to maintain Amps. #1 (Main) at 1.5 to 2.0 Amps; #2 (Aux.) at .5 to 1.0 Amps.

☐ Automatic—Rectifiers are not to be adjusted as they are pre-set. For optimum effect potential level meter should read ____ mv. ±25 mv.

DATE OF INSPECTION 5/4/81 **DATE** ____ **TIME** ____

SIGNED FOR HARCO BY J. Storm **SIGNED FOR CUSTOMER BY** ____

See back for additional comments. CUSTOMER PHONE # ____

HARCO Harco Corporation
2567 PARK CENTRAL BOULEVARD
DECATUR, GEORGIA 30035 404/981-3150

WATER TANK WORK ORDER / CATHODIC PROTECTION SERVICE REPORT

For Camp Lejeune
Jacksonville, N.C.
Tank No. S-5
Area 2

Harco Job No. T48844
Contract Type
Tank Type 300m gal.
Rectifier # 4108

Customer P.O. # N62470-79-B-2646
Contract Effective
Heated Yes ☐ No ☐
Controller Card No.

SERVICE CREW INSTRUCTIONS: Before and and after servicing system notify

1. Anodes ☐ Replace all anodes ☐ Inspect all anodes
2. Make other minor repairs required to provide effective cathodic protection.
3. Test and adjust equipment and provide the customer with a copy of results and operating instructions.
4. Evaluate repairs required that are outside the scope of this order and notify both the customer and Harco office.

ANODE CONFIGURATION:

	Type	Size
Ring 1	10 HiSi w/8 Sec.	
Ring 2	5 " w/1 Sec.	
Ring 3	1 " w/31 Sec.	
Ring 4		

FOR SERVICE CREW USE ONLY

Condition	No. Inspected	No. Replaced
New	10	
"	5	
"	1	

ESTIMATED JOB TIME /HRS.

SERVICE CREW COMPLETE THIS SECTION

Rectifier Repair wiring Reference Cells
Wiring Repaired Suspension New

SYSTEM FOUND OPERATING AT: D.C. Volts Off ;D.C. Amps #1 (Main) , D.C. Amps #2 (Aux.) ;
Potential Level ; Set Point ; Tap ; Water Level ; Fuses ;

RESISTANCE READINGS: Bowl Ckt. ; Riser Ckt. ; Reference Ckt. ;

SYSTEM LEFT OPERATING AT: D.C. Volts 4.5 D.C. Amps #1 (Main) 2.5 D.C. Amps #2 (Aux.) .5
Energized Potential Set Point Natural Potential Tap Setting A-1

POTENTIAL TEST RESULTS: Testing with high resistance V.M. and Harco Permacell

Location	Top	Natural	1.00	On	1.41	Instant Off	1.02
Location	Middle	Natural	.970	On	1.10	Instant Off	.98
Location	Bottom	Natural	.900	On	.99	Instant Off	.93

Repairs or replacements required for optimum performance not covered by this service.

CUSTOMER OPERATING INSTRUCTIONS: To insure continuous Cathodic Protection the rectifier should be inspected once a month with report cards completed and mailed.

☒ Manual—Rectifier should be adjusted to maintain Amps. #1 (Main) at 2.0 to 3.0 Amps; #2 (Aux.) at .3 to .7 Amps.

☐ Automatic—Rectifiers are not to be adjusted as they are pre-set. For optimum effect potential level meter should read mv. ±25 mv.

DATE OF INSPECTION 5/4/81 **DATE** **TIME**

SIGNED FOR HARCO BY J. Storm **SIGNED FOR CUSTOMER BY**

See back for additional comments. CUSTOMER PHONE #