Office of the City Manager City of Richland Hills, Texas

Memorandum

To: Honorable Mayor Bill Agan and members of the Richland Hills City Council

From: Michael Barnes, Public Works Director

Date: April 26, 2013

Subject: Levee Switchgear Repair

Council Action Requested:

Approve Alan Plummer & Associates, Inc. (APAI) recommendation to prepare plans and specifications for the replacement of the switchgear at the Levee Pump Station.

Background Information:

On February 19, 2013 council approved a contract with APAI to inspect the 45 year old switchgear at the Levee Pump Station and submit a report recommending either the repair or replacement of said switchgear. Following their evaluation, APAI is recommending that we proceed with replacement rather than repair.

Attached is the Technical Memorandum™(TM) from APAI describing the condition of the Levee Pump Station Switchgear. APAI electrical engineer, Patrick Moseley, P. E., will review with the council the attached Technical Memorandum and answer any questions the council may have.

The TM major points of interest include the following:

1. Background Information – Reviews the condition of the Levee Switchgear.
2. Additional Maintenance, Testing and Evaluation of the Switchgear - Describes the maintenance, testing and evaluation that has been performed to date.
3. Immediate Recommendations – APAI recommends that the monthly testing of the pumps be suspended, install a remote on/off SCADA program for the

pumps, and refill oil containers for proper and safe operation of the electrical switchgear.

4. Evaluation of the Switchgear – Describes and evaluates the major components of the switchgear that was inspected.
5. Additional Considerations – Explains additional items, not covered under APAI contract, evaluated for the proper operation of the pumps.
6. Refurbish the Existing Switchgear – Describes the process and time required for refurbishing the existing switchgear, length of life expected after switchgear is repaired (15 years), and estimated cost to refurbish switchgear ($93,720.00).
7. Replacement of Existing Switchgear – describes the process to design, bid, and install new switchgear, expected life of new switchgear (40-50 years), and cost of the new switchgear ($115,200.00).
8. Recommendation – APAI is recommending installation of new switchgear at an estimated cost of $115,200.00. This also allows for a shorter time (1-2 weeks) for the pump station to be out of service.

Staff agrees with the APAI recommendation and recommends approval of designing and installing new switchgear rather than replacement of the existing switchgear. Our current agreement with APAI provides for the design of either the repair or replacement of the switchgear. This agreement was approved by Council at the February 19, 2013 in the amount of $44,900. Once the design is completed, we will put the project out to bid and bring the item back to the Council for consideration of the bid award.

Board/Citizen Input: N/A

Financial Impact: No additional funds required for this phase. Estimated $115,200 from Drainage Utility Fund at the time of the bid award.

Staff Contacts:

Michael Barnes, P.E. Director of Public Works
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Attachments: Alan Plummer Associates, Inc. Technical Memorandum

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS • DESIGNERS • SCIENTISTS

TECHNICAL MEMORANDUM

City of Richland Hills
Levee Pump Station
2300-Volt Switchgear

STATE OF TEXAS
PATRICK N. MOSELEY
72794
REGISTERED PROFESSIONAL ENGINEER
4/25/13

Project No.: 1733-002-01

Date: April 24, 2013

Prepared For: Michael Barnes, PE, City of Richland Hills

Prepared By: Patrick N. Moseley, P.E., Alan Plummer Associates, Inc.

cc:

1.0 BACKGROUND INFORMATION

In January 2013, The City of Richland Hills (City) performed the monthly maintenance operation of the levee (storm water) pump station and discovered that the main breaker of the switchgear (installed circa 1966) would not remain closed. The City retained the services of Shermco Industries (Shermco), a certified InterNational Electrical Testing Association (NETA) service company, to investigate and repair the breaker. On January 7, 2013, Shermco investigated and found that the spring mechanism and the mechanical holding latch were not functioning properly. It appears that the mechanical portions of the breaker had not been cleaned nor lubricated in a number of years. Once cleaned and lubricated, the breaker performed satisfactorily. Medium-voltage breakers use springs to quickly close and open the current components of the breakers. Quickly opening and closing the breaker reduces the amount of time an electrical arc can exist between the current components. (Refer to Figure 1 for a reference picture of the medium-voltage breaker.) Maintenance of a 2,300-volt electrical gear is both complex and potentially dangerous, making this a task that should only be performed by trained service personnel.

As part of their findings during the repair, Shermco initially recommended the following items as shown in their report (provided as Appendix A):

1. Acquire a spare breaker to replace each breaker in turn and have each breaker refurbished.
2. Conduct on-site maintenance of the breakers.
3. Clean and test the switchgear lineup.
4. Test the relays.

After receiving additional testing costs from Shermco, the City had concerns about the price and availability of the replacement parts as well as the advanced aged of the switchgear, and they determined

that it would be in the City's best interest to evaluate the costs and advantages of either maintaining the gear,conducting a major refurbishment of the gear, or replacing the gear. To help in this procedure and to prepare the required documents, the City retained the consultant engineering services of Alan Plummer Associates, Inc. (APAI).

2.0 ADDITIONAL MAINTENANCE, TESTING, AND EVALUATION OF THE SWITCHGEAR

APAI originally estimated replacement of the switchgear at approximately $120,000. Without further testing of the existing switchgear, APAI could not determine the cost of refurbishing the existing gear. In concurrence with the City, APAI issued a Requested for Proposal (RFP) with a defined scope for testing and maintenance of the existing switchgear. The RFP had three goals: (1) to provide the required maintenance and testing of the gear to help ensure operation of the switchgear for another calendar year, (2) to determine any immediate recommendations for safety and use of the switchgear, and (3) to determine the items required for refurbishment of the switchgear to provide another 15 years of satisfactory life.

On February 26, 2013, under part of APAI's contract, an RFP was issued to two (2) NETA-franchised firms in the North Texas Area: Shermco and N'TNL Field Services (N'TNL). Both firms responded to the RFP, with N'TNL being selected as presenting the most responsive proposal. A testing date of April 5, 2013, was coordinated with all parties.

Before this date occurred, Shermco submitted their final recommendations (Appendix B) on March 29, 2013. In this document, they recommended replacement of the gear, the same testing and maintenance that was required in the RFP, and provided additional condition of the switchgear and recommendations that would be found during the April 5 work.

N'TNL has not yet issued their final test report or recommendations, but their findings and observations in the field were discussed between N'TNL and APAI. These findings and observations have been separated into Immediate Recommendations and Evaluation of the Switchgear.

3.0 IMMEDIATE RECOMMENDATIONS

During opening/closing operation of medium-voltage (2,300- to 15,000-volt) breakers, the current conducting material is put into a position that creates an arc before contact is made (closing) or before the contact is separated at a distance (opening). If it is not contained, this arc will cause catastrophic failure of the breaker. This would result in damage to switchgear and possible injury and even death to personnel standing by the switchgear. Breakers of this age use dielectric oil as an insulating material to prevent the arc. Current designs of breakers utilize either a vacuum or an insulating gas.

Resistance testing of the fluid indicates that the oil no longer has the recommended dielectric strength to prevent arcs. In addition, oil level is at a minimum level (Figure 2). Based upon this finding, the following recommendations should be performed immediately:

3.1 Discontinue Monthly Testing of the Pump Station

The original operation and maintenance manual recommended that each of the breakers be manually operated from the field once a month. With the oil in its current weakened condition, this could produce an arc flash, resulting in damage to the switchgear and, more importantly, injury or death to personnel. Monthly testing of the gear should be suspended until Immediate Recommendations 1 and 2 have been accomplished.

3.2 Immediate Recommendation 1

Enhance the current remote control system to allow monthly operation of the pump station from a remote monitoring computer. Under this operation, the maintenance staff would step outside of the building while a second staff member started the pumps remotely from the computer. If an arc flash occurs, the switchgear would still be damaged, but the maintenance staff would be at a safe distance. This recommendation would be suggested even if the switchgear was replaced.

3.3 Immediate Recommendation 2

Replace the existing weakened dielectric oil with new dielectric oil filled to the proper level. The existing oil will probably contain Polychlorinated Biphenyls (PCBs), and Environmental Protection Agency (EPA) regulations would need to be addressed when the oil is replaced.

3.4 Continued Use of the Switchgear

Upon completion of these two (2) recommendations and based upon the additional test reports, the calibration of the protective relays, and the history of limited runtimes hours and number of operations, the switchgear should have another two (2) to four (4) years of satisfactory use.

4.0 EVALUATION OF THE SWITCHGEAR

The switchgear is a customized design and built by Generator Electric in 1966. The gear consists of a main breaker and a breaker for each pump. (Refer to Figure 3 for single line diagram of the switchgear.) The breakers for the pump act as motor controllers. The switchgear has been customized in manner that gives it several design flaws. First, the breakers are inserted from the rear of the gear. This makes replacement difficult, as they would have to be lifted over the gear. The internal bussing from the breaker

to the main buss is customized. (Refer to Figure 4 for images of the customized bussing.) If a replacement breaker is required, new, customized bussing would be necessary.

4.1 Breakers

As discussed previously, the breakers (current currying components) are immersed in oil. As shown in Figure 5, the gasket—which allows the connection bushing to penetrate the oil tank—is leaking. With each operation of the breaker, a small amount of oil is vaporized to control the arc. In addition, the movement of the breaker contacts in the oil will cause wave action in the tank. These two actions, in combination with a poor grommet, allowed oil to leak from the tank. . If these breakers were to be refurbished as originally recommended by Shermco, the availability of these parts and other required parts is both highly questionable and costly. It would simply be easier, more timely, and probably more cost-effective to replace the breaker unit with new retrofit vacuum-style breakers.

4.2 Buss

Switchgear standard design allows conductive metal (copper) bars (busses) to carry current from the main breaker to the pump breakers. Standards also allows for these bars to be un-insulated (bare) as long as the minimum required distance is maintained between the phases (three bars, one for each phase). When this distance cannot be maintained, an insulation wrap around the buss is required. Figure 5 shows the insulation wrapped around the buss. At areas close to the breakers, oil has impregnated the insulation wrapping. The resistance testing between the buss bars does not indicate any deterioration of the insulating wrapping; however, it is a matter of time before either the oil breaks down the installation wrapping or dirt and grease builds up enough to allow an arc flash between busses.

4.3 Incoming Feeders

Testing of the insulation of the incoming feeders proved them to be acceptable; however, medium-voltage feeders have a ground shield between the inner insulation and outer insulation, and this shield was missing from one of the feeders, presumed to be corroded away. This shield provides protection for the equipment and personnel by directing any fault in the cable to ground.

4.4 Batteries

48DC-volt batteries are used to open and close the breakers. These batteries are a wet-cell design that is outdated and produce off-gases. (Refer to Figure 6 for an image of the batteries.) Battery-operated systems have typically been phased out in most switching systems since the 1980s. Most operating and closing systems in modern designs use capacitors to charge the opening/closing mechanisms.

4.5 Protective Relays

The pumps are protected from overcurrent and low voltage by electro-mechanical relays. These relays are functional and were recalibrated. Current technology, solid-state relays offer additional protection in a much smaller footprint. However, the existing relays offer the minimum protection required and do not have to be replaced. It is recommended that the relays be calibrated and tested once a year to ensure protection of the pumps.

4.6 Switchgear Enclosure Heaters

The switchgear contains six (6) strip heaters that are used to prevent condensation from forming within the electrical gear. The strip heaters are not functional. Wiring to heaters has damaged insulation, causing it to become brittle and leaving the conductors exposed. (Refer to Figure 7 for an image of the heaters.)

5.0 ADDITIONAL CONSIDERATIONS

Additional considerations were given to the evaluation of the switchgear that was not directly included in APAI's scope or the RFP issued to the testing companies. These items are as follows:

5.1 Electrical Testing of the Pump Motors

During Shermco's work on January 18, 2013, electrical testing was performed on the pump motors. This testing reflects that the motors performed satisfactorily and are suitable for continued service. (Refer to Appendix C.)

5.2 Pump Feeder Cables

At this time, the pump feeder cables have not been tested. Medium-voltage power cables are qualified by various manufacturers to provide a specified life of anywhere from 20 to 30 years of continued service based on optimal environmental and operating conditions. These cables have exceeded the life expectance given by cable manufacturers by 20 to 30 years. However, these cables were not in continuous service and are in a relatively clean environment, and a 50-year lifespan is not unreasonable. Consideration should be given to replacing pump feeder cables. If switchgear replacement is selected, new cable would be required to reach new terminal points within the gear.

5.3 Standby Power Generation

Storm water pump stations such as this one are required to meet the requirements of the U.S. Corps of Engineers (Corps). The Corps does not require standby power generation; they consider the pump station for emergency pumping only, and loss of power at the same time would be considered, in effect, a

double emergency. To required standby generation, the area would have to be subject to an extended loss of power during flooding events.

6.0 REFURBISH THE EXISTING SWITCHGEAR

It is possible to refurbish the existing switchgear. The work required to perform this tasks includes replacement of the oil-insulated breakers with current vacuum-style breakers with required customized buss work, replacement of incoming and pump feed cables, replacement of the existing buss insulation material, replacement of batteries with current generation batteries, and replacement of condensation heaters.

This work would be best performed under a purchase order issued by the City after an RFP has been issued. Bidders would probably be limited to two or three qualified firms. Refurbishing the gear would take place approximately three (3) months after issue of the purchase order. Refurbishing the electrical system would take approximately three (3) weeks. During this time, the pump station would be out of service. After the refurbishing the switchgear, it is anticipated that another 15 years of serviceable life can be expected.

The table below outlines an opinion of probable cost of refurbishing the pump station switchgear. Not included in the estimate is the cost of the immediate recommendations.

Item	Quantity	Unit Cost	Extended Cost
Replacement of Breakers with Vacuum-Style Breakers	3	$16,000	$48,000
Replacement of Insulation Wrap Around Bussing	1 Lot	$6,000	$6,000
Customized Buss Work	1 Lot	$7,500	$7,500
Replacement of Incoming Feeder	1	$6,000	$6,000
Replacement of Pump Feeders	2	$3,000	$6,000
Replacement of Batteries	2	$800	$1,600
Replacement of Heaters	6	$500	$3,000
Subtotal	–	–	$78,100
Contractor O&P (20%)	–	–	$15,620
Total	–	–	$93,720

7.0 REPLACEMENT OF THE EXISTING SWITCHGEAR

The existing switchgear can also be replaced with new switchgear, with an incoming fused switch and two vacuum motor controllers. The switchgear will utilize current generator protective relays and capacitors to open and close the motor controllers. The new switchgear arrangement will be designed to allow disconnection of power at the gear rather than relying on power company personnel to disconnect service at the incoming transformers. (Refer to Figure 8 for a single line diagram of the new switchgear lineup.)

This work would be best performed under a traditional design-bid-construction contract. It is anticipated that five (5) qualified contractors would responded to the bid. Replacement of the switchgear gear would occur approximately five (5) months after the issue of notice to proceed. Replacement of the electrical system would take approximately one and a half (1.5) weeks. During this time, the pump station would be out of service. After the replacement of the switchgear, it is anticipated that another 40 to 50 years of service can be expected.

The table below outlines an opinion of probable cost of the replacement of the pump station electrical system. Not included in the estimate is the cost of the immediate recommendations.

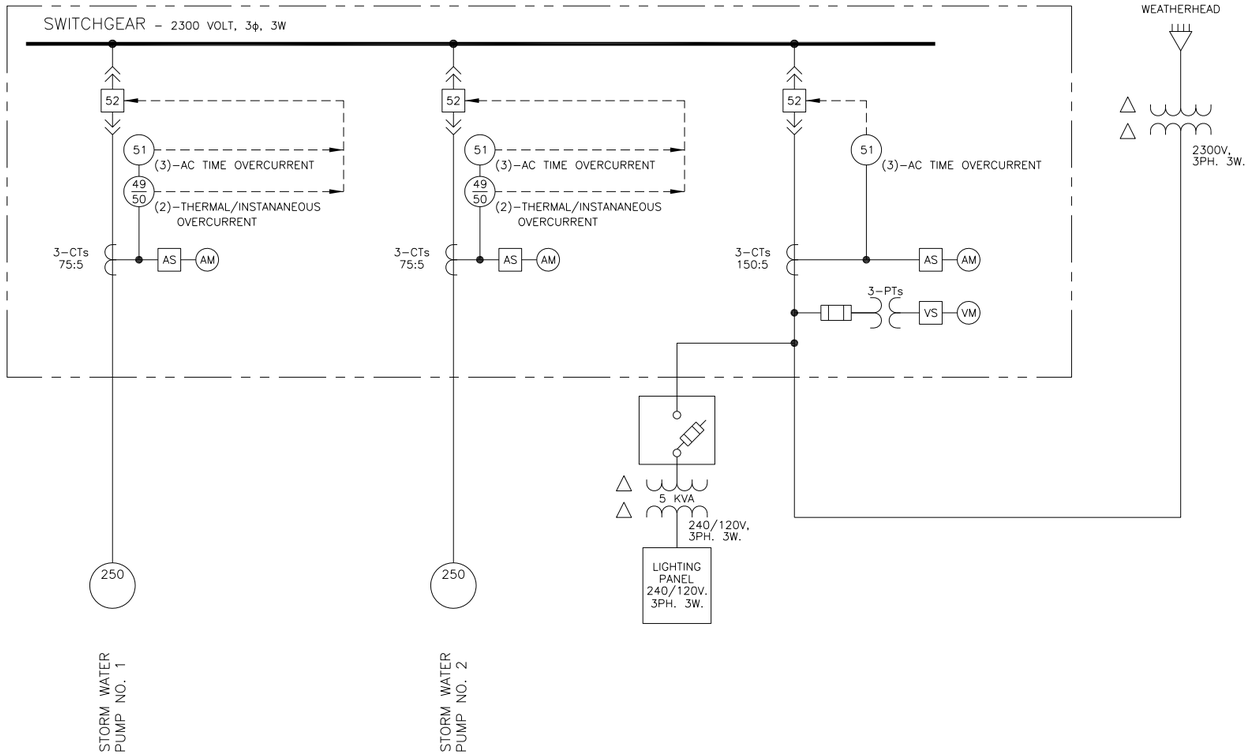
Item	Quantity	Unit Cost	Extended Cost
Replacement Switchgear	1	$84,000	$84,000
Replacement of Incoming Feeder	1	$6,000	$6,000
Replacement of Pump Feeders	2	$3,000	$6,000
Subtotal	–	–	$96,000
Contractor O&P (20%)	–	–	$19,200
Total	–	–	$115,200

8.0 RECOMMENDATION

APAI recommends that the existing switchgear be replaced. This recommendation is based upon the relatively small price difference of $23,000 between the two options, the additional protection afforded in the current generation of relays and breakers, and the anticipated extended service life of the new switchgear. The new switchgear will enhance operator safety during operations, by reducing the potential of ARC Flash incidents.

FIGURE 1
MEDIUM VOLTAGE BREAKER

FIGURE 2
OIL SITE GAUGE



SWITCHGEAR ONE–LINE

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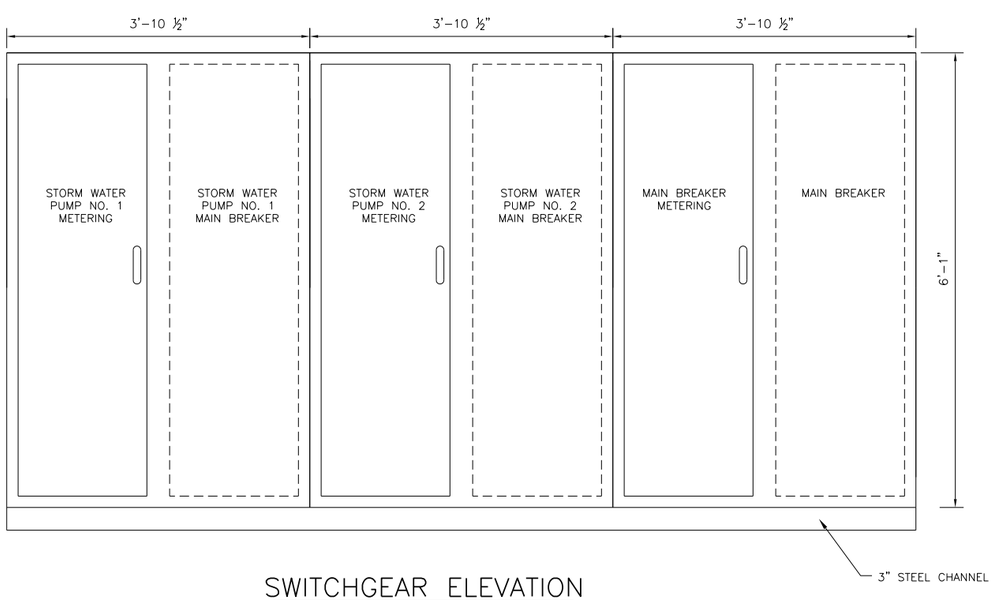
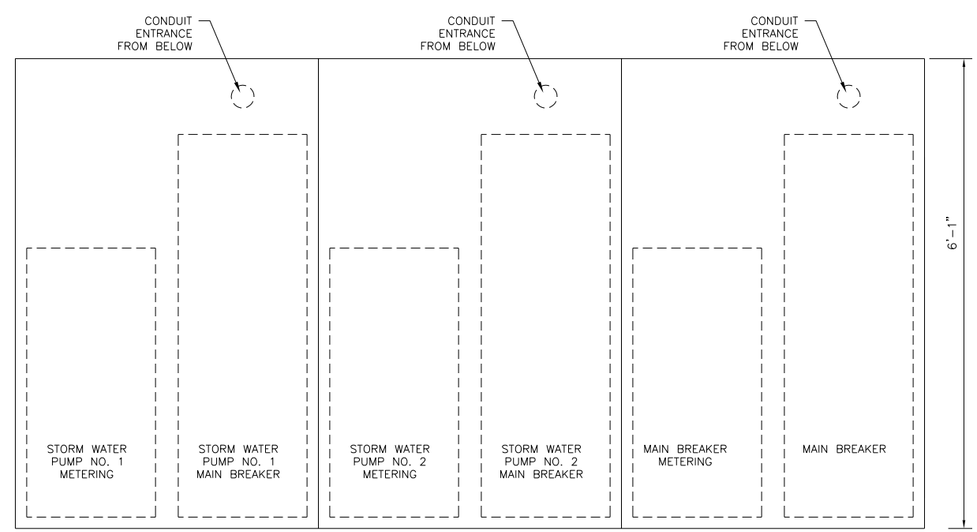


SWITCHGEAR ELEVATION

SCALE: NOT TO SCALE



SWITCHGEAR PLAN

SCALE: NOT TO SCALE

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6B -

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FORT WORTH, TEXAS 76107-5764
PHONE: 817-806-1700 FAX: 817-870-2536
TEXAS REGISTERED ENGINEERING FIRM F-13

NO.	DATE	REVISION	BY

CITY OF RICHLAND HILLS, TX

CITY OF RICHLAND HILLS
STORM WATER PUMP STATION

ELECTRICAL
EXISTING SINGLE LINE DIAGRAM

THESE DOCUMENTS ARE FOR INTERIM REVIEW AND ARE NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES.
PATRICK N. MOSELEY
TEXAS P.E. NO. 72794
DATE: 4/24/2013

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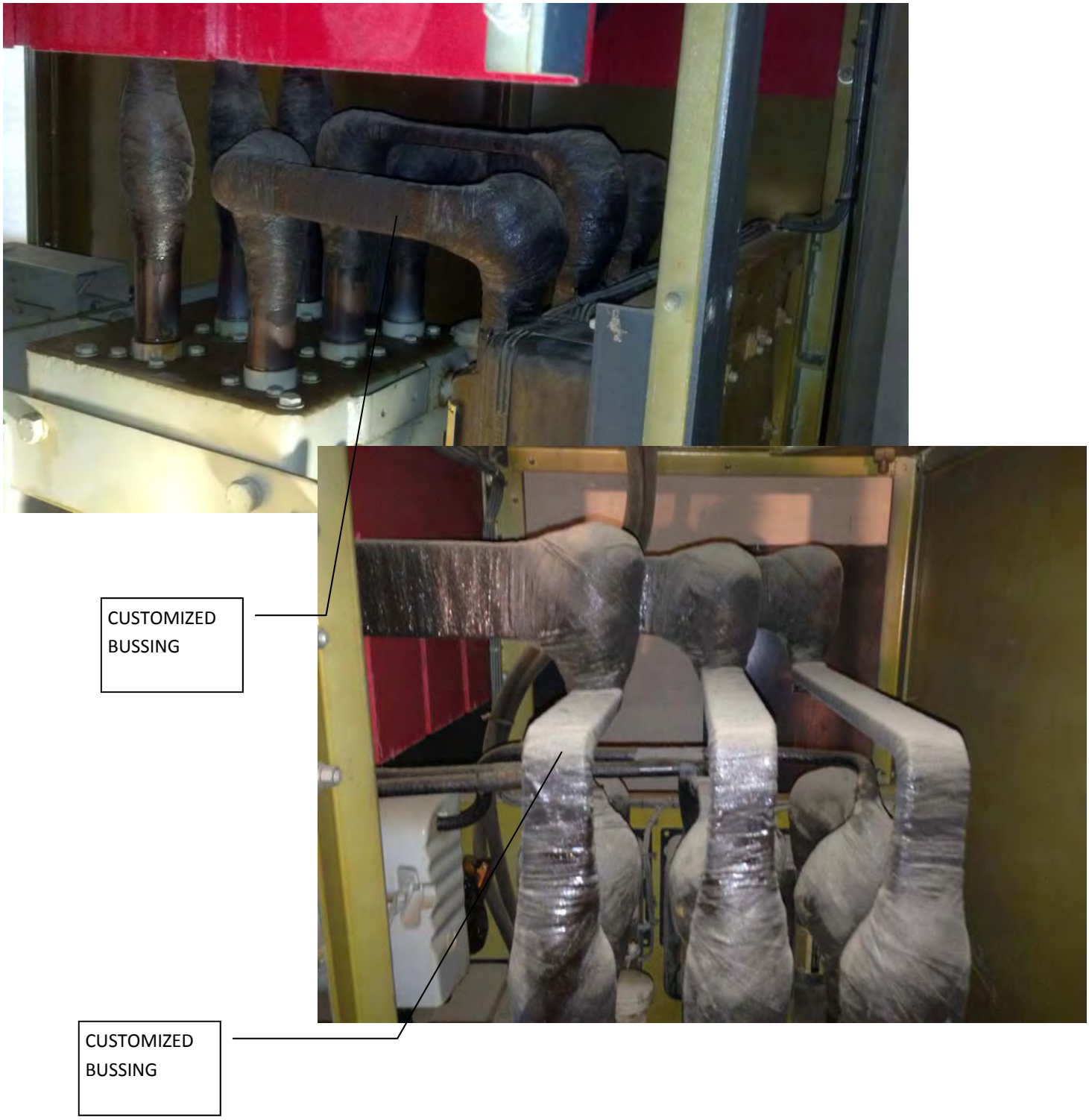


FIGURE 4
CUSTOMIZED BUSSING

FIGURE 5
LEAKING GASKET AND INSULATING WRAP

FIGURE 6
BATTERIES

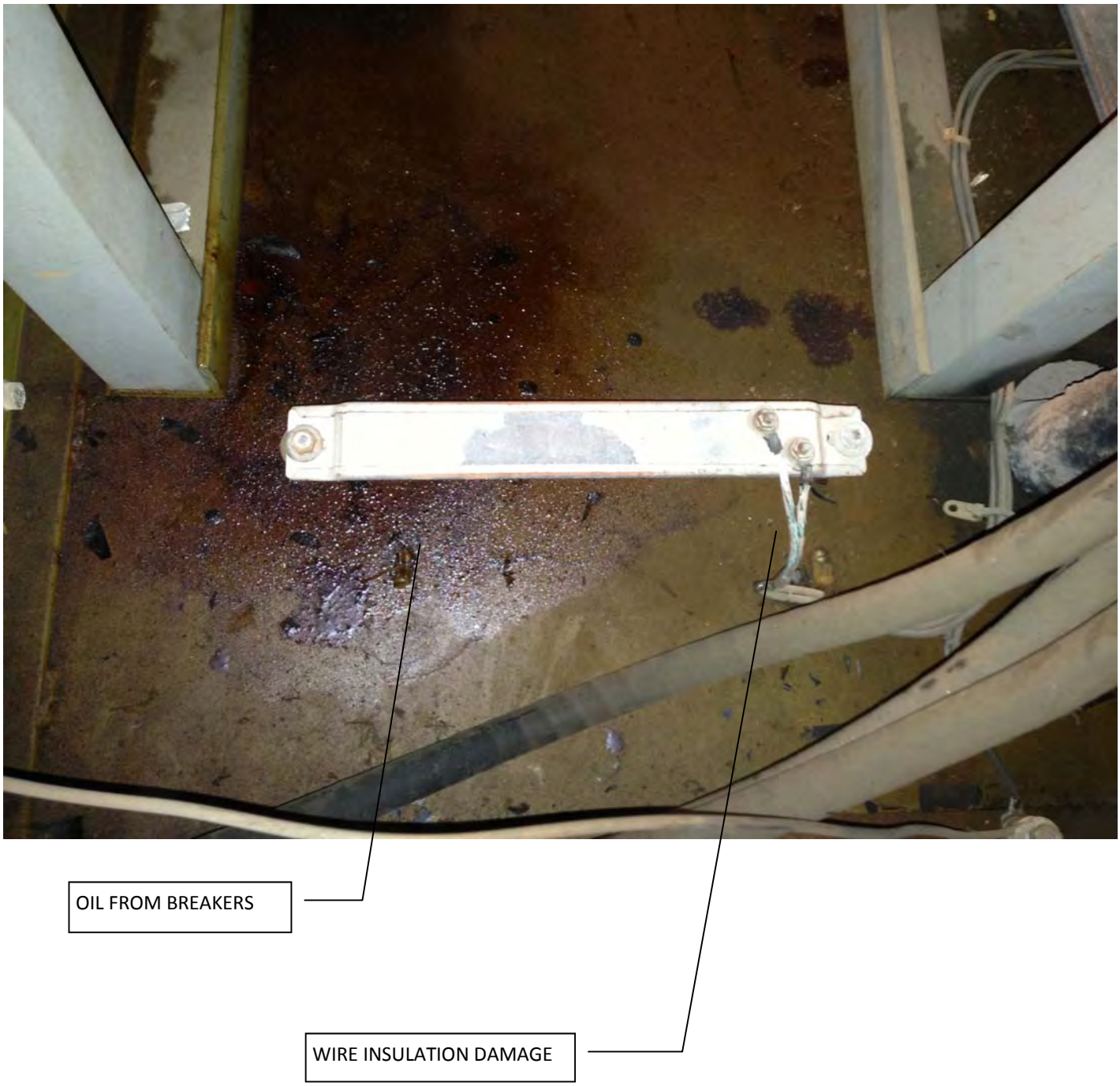
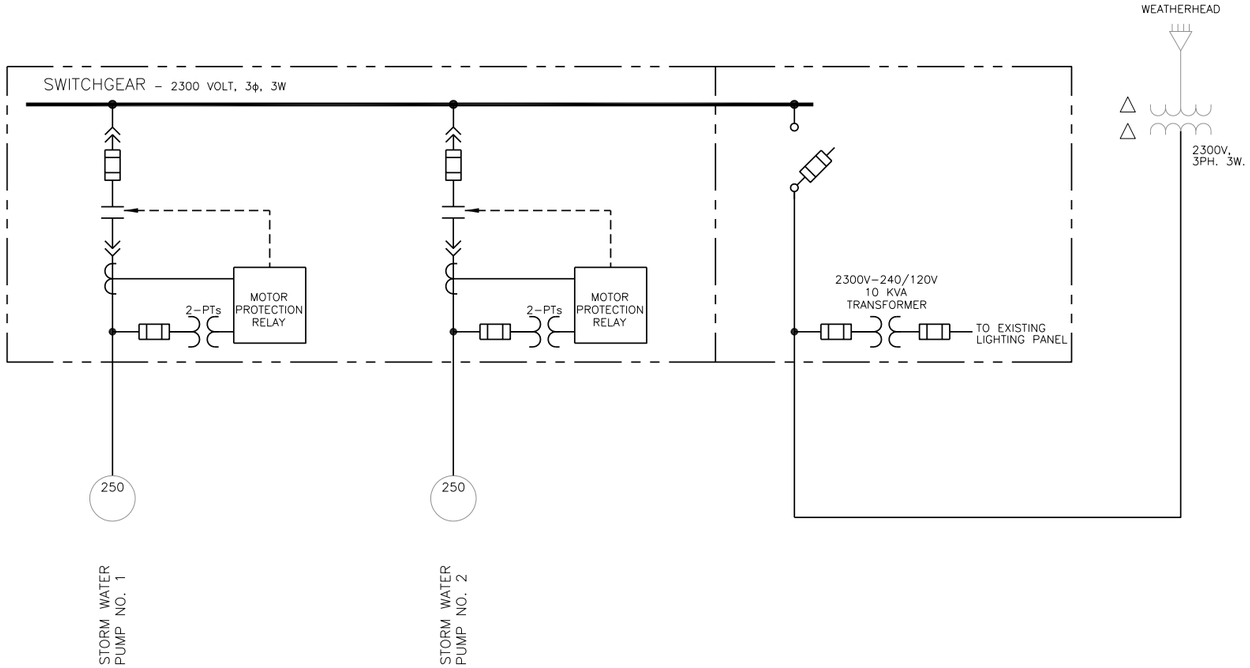


FIGURE 7
CONDENSATION HEATERS



SWITCHGEAR ONE–LINE

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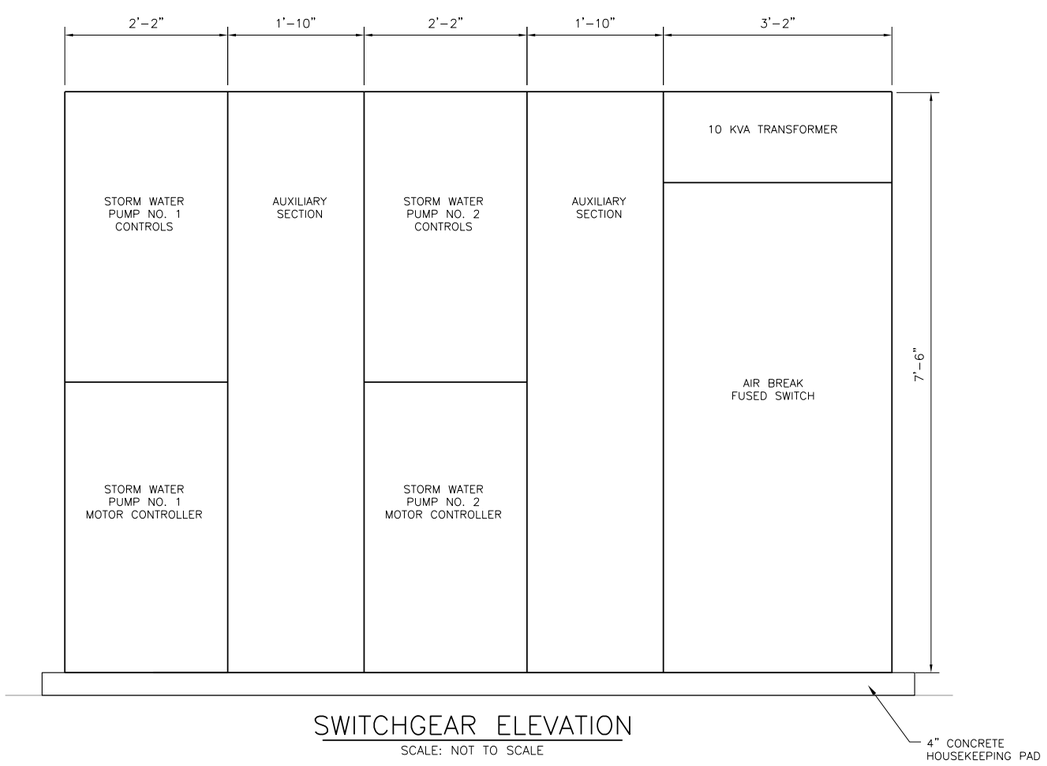

SWITCHGEAR ELEVATION

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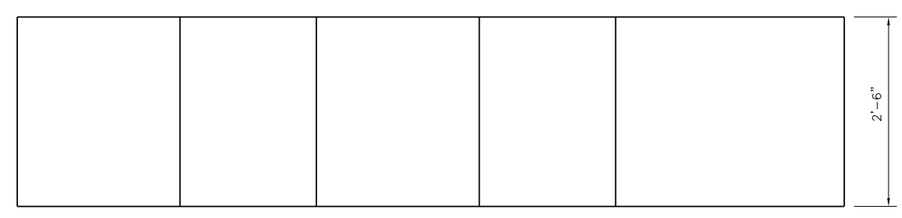

SWITCHGEAR PLAN

SCALE: NOT TO SCALE

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NO.	DATE	REVISION	BY

CITY OF RICHLAND HILLS, TX

CITY OF RICHLAND HILLS
STORM WATER PUMP STATION

ELECTRICAL
PROPOSED SINGLE LINE DIAGRAM

THESE DOCUMENTS ARE FOR INTERIM REVIEW AND ARE NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES.
PATRICK N. MOSELEY
TEXAS P.E. NO. 72794
DATE: 4/24/2013

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PRINTED: 4/24/2013 11:46 AM L:\Projects\1733\002-01\Acad\SHEETFILES\ELECTRICAL\FIGURE 8.dwg SAVED: 4/24/2013 11:17 AM USER: Moseley, Patrick

Shermco industries®

One Line. One Company.®

Customer: City of Richland Hills

Location: Pump Station
Richland Hills, Texas

Shermco Project No.: 208369

Description: Troubleshoot Circuit Breaker

Date: January 7, 2013

Work Performed and Report Prepared By:
Shermco Industries
Corporate Headquarters | Dallas Service Center
2425 E. Pioneer Dr., Irving, TX 75061

Appendix A

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January 30, 2013

Mr. Ken Cross
Mr. Michael Barnes
City of Richland Hills
3200 Diana Drive
Richland Hills, TX 76118

Subject: **Troubleshoot Circuit Breaker**
Shermco Project No.: 208369

Location: **Pump Station**
Richland Hills, Texas

Dear Mr. Cross and Mr. Barnes:

On January 7, 2013, Shermco Industries inspected a circuit breaker for the City of Richland Hills at a pump station located in Richland Hills, Texas.

Our investigation revealed that the main breaker would not stay closed when operated due to lack of lubrication to the rollers and cams of the closing mechanism. Once lubricated, the breaker was able to close. The two pump breakers were also lubricated.

This is a temporary solution. The lubrication does not properly penetrate all areas of the mechanism. The following are our recommendations:

1) Acquire a spare breaker to replace each breaker in turn and have each breaker refurbished.
2) Conduct onsite maintenance of the breakers. Longer down time is required.
3) Clean and test the switchgear lineup.
4) Test the relays.

Thank you for the opportunity to be of service. Should you have any questions or require additional information or services, please do not hesitate to contact us. We are available 24 hours a day, seven days a week.

Respectfully submitted,
Shermco Industries
Dallas Service Center

George F. Cerniglia
Protection and Controls Supervisor
Engineering Services Division

Shermco industries®

One Line. One Company.®

Customer: City of Richland Hills

Location: Richland Hills, Texas

Shermco Project Number: 604096

Project description: Electrical test two 250hp pump motors

Date: February 28, 2013

Work Performed and Report Prepared By:
Shermco Industries
Corporate Headquarters | Dallas Service Center
2425 E. Pioneer Dr., Irving, TX 75061

Appendix B

Shermco industries®

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February 28, 2013

Michael Barnes
City of Richland Hills
3200 Diana Drive
Richland Hills, TX 76118

Subject: **Electrical test two 250hp pump motors**
Shermco Project No.: 604096

Location: **Richland Hills Pump Station**

Dear Mr. Barnes:

On January 18, 2013 Shermco Industries performed electrical testing of two 250hp pump motors for the City of Richland Hills located and the Richland Hills Pump Station.

Project scope of work:

- Perform Advanced Winding Analyzer (AWA) testing of two 250hp pump motors
- Analyze and report

Observations:

- Both motors tested satisfactory and are suitable for continued service

Recommendations:

- Perform vibration analysis and online testing as part of a regularly scheduled preventive and predictive maintenance program

Thank you for the opportunity to be of service. Should you have any questions or require additional information or services, please do not hesitate to contact us. We are available 24 hours a day, seven days a week.

Respectfully submitted,
Shermco Industries
Dallas Service Center

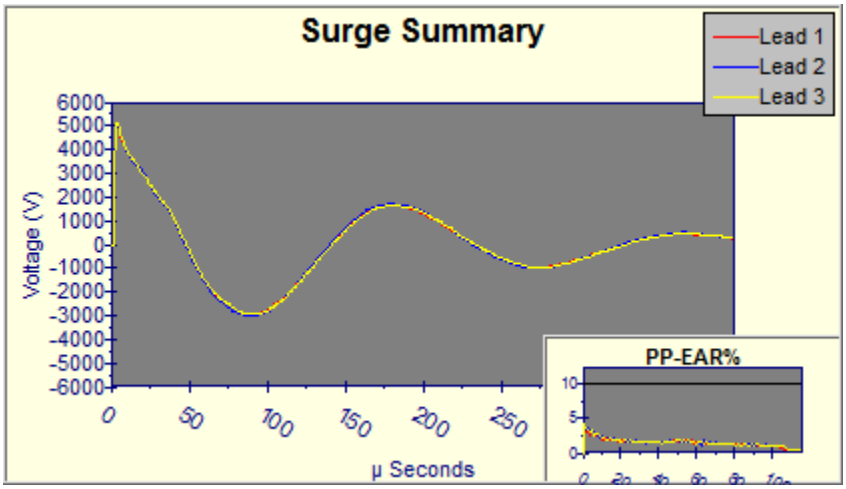
Jason Edwards
Technical Analyst
Machine Services Division

Results Summary Log

Motor ID	Time	Temp	Resist	Megohm	DA/PI	DC	Surge
1	1/18/2013 11:07:45 AM	Tested	PASS	PASS	PASS	--	PASS

Nameplate Information		Motor ID 1	
Location	City of Richland Hills	Building	Pump Station
Model	5K6336XC144A	Manufacturer	GE
Serial Number	MAJ1229011	HP/KW	250
Volts-Rating	2300	Volts-Operating	2300
Amps-Rating	63.5	Amps-Operating	63.5
Insulation		Enclosure	
RPM	705	Service Factor	0
Frame	6336P30	Freq-Hz	60
LR Code		LR Amps	0
NEMA Design		Max Amb °C	0
NEMA nom eff	0	Duty Cycle	
Manuf's Type	CSF	Manuf Dt Cd	
Description	250 HP AC MOTOR		

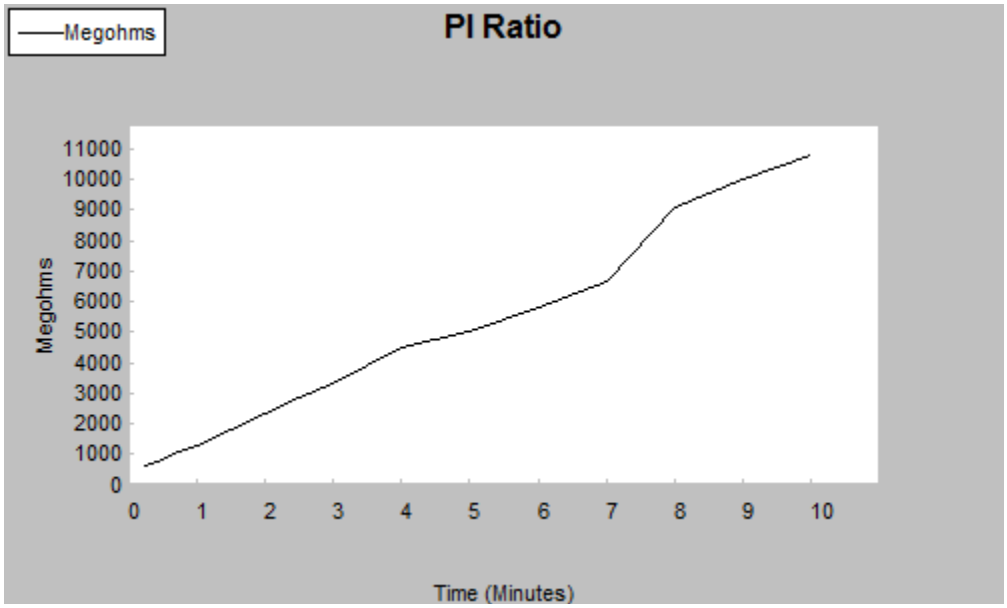
Results Summary		Test Date/Time 1/18/2013 11:07:45 AM	
Test ID:	2300V with PI	Repair/Job #	604096
Tested By		Tested For	
Room #		MCC	
Location	City of Richland Hills	Building	Pump Station
Temp Status	**Tested**	**PI Status**	**PASS**
Temp	14.0°C 57.2°F	Volts (V)	4000
Resist Status	**PASS**	DA Ratio	4.0
L1-L2 (Ohms)	0.749 Corr: 0.782	PI Ratio	8.4
L2-L3 (Ohms)	0.747 Corr: 0.780	**HiPot**	**No Test Performed**
L3-L1 (Ohms)	0.747 Corr: 0.780	Volts (V)	0
Max Delta R %	0.270	I(µA)	0
Coil 1 (Ohms)	0.374 Corr: 0.391	Resist (Mohm)	0
Coil 2 (Ohms)	0.374 Corr: 0.391	**Surge Status**	**PASS**
Coil 3 (Ohms)	0.372 Corr: 0.389	Peak Volt(V) L1	5600
Megohm Status	**PASS**	Peak Volt(V) L2	5600
Volts (V)	4000	Peak Volt(V) L3	5650
I(µA)	3.10	Max P-P EAR(%)	3.5/4.2/4.2
Resist (Mohm)	1290 At 40°C 212	EAR 1-2/2-3/3-1(%)	No Test



Tester Info: 99-A412-00E T-01-06; 457; Cal Dates: 09/12/2012 - 09/12/2013

DA/PI		Motor ID 1	
Test Date/Time	1/18/2013 11:07:45 AM	Voltage (V)	4000
DA Ratio	4.0	PI Ratio	8.4
PI Status	PASS		

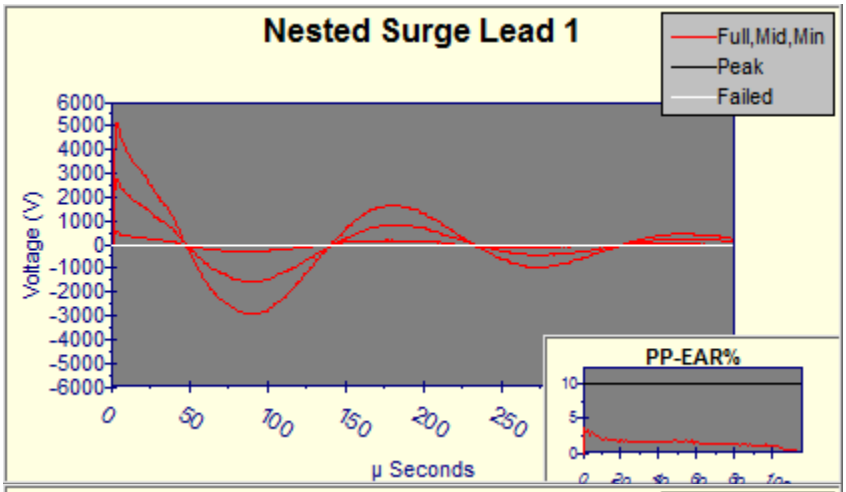
Time (Min)	I(µA)	Megohms
0:15	6.72	595
0:30	4.76	838
0:45	3.70	1081
1:00	3.09	1294
1:30	2.20	1818
2:00	1.70	2352
2:30	1.39	2877
3:00	1.20	3325
4:00	0.89	4483
5:00	0.80	5000
6:00	0.69	5797
7:00	0.60	6666
8:00	0.44	9090
9:00	0.40	10000
10:00	0.37	10810

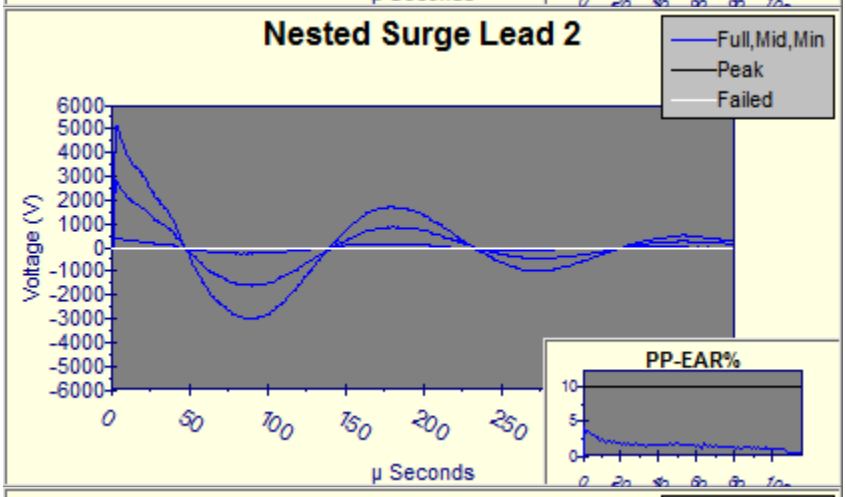


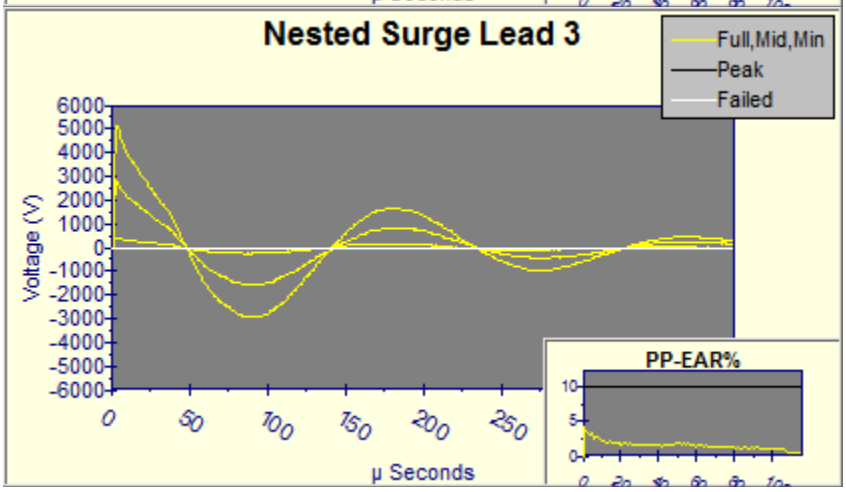
Tester Info: 99-A412-00E T-01-06; 457; Cal Dates: 09/12/2012 - 09/12/2013

Surge: Nested Waveforms		Motor ID 1	
Test Date/Time	1/18/2013 11:07:45 AM	Surge Status	PASS

Lead	Peak Voltage (V)	PP EAR Status	Max P-P EAR(%)
1	5600	PASS	3.5
2	5600	PASS	4.2
3	5650	PASS	4.2

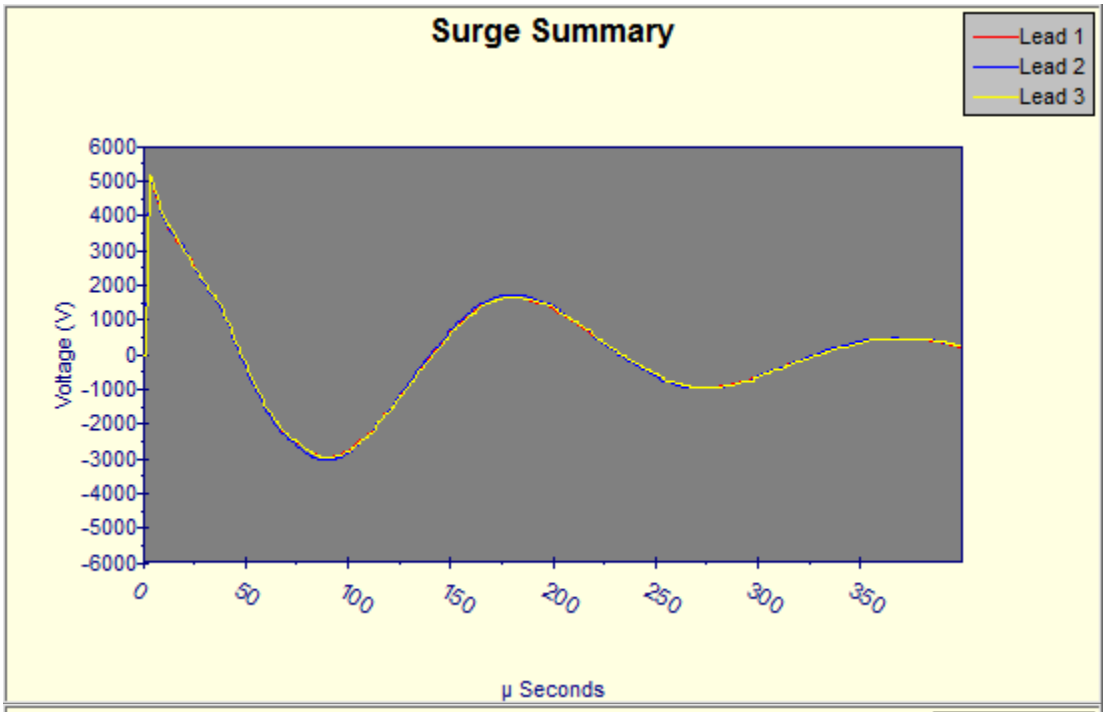


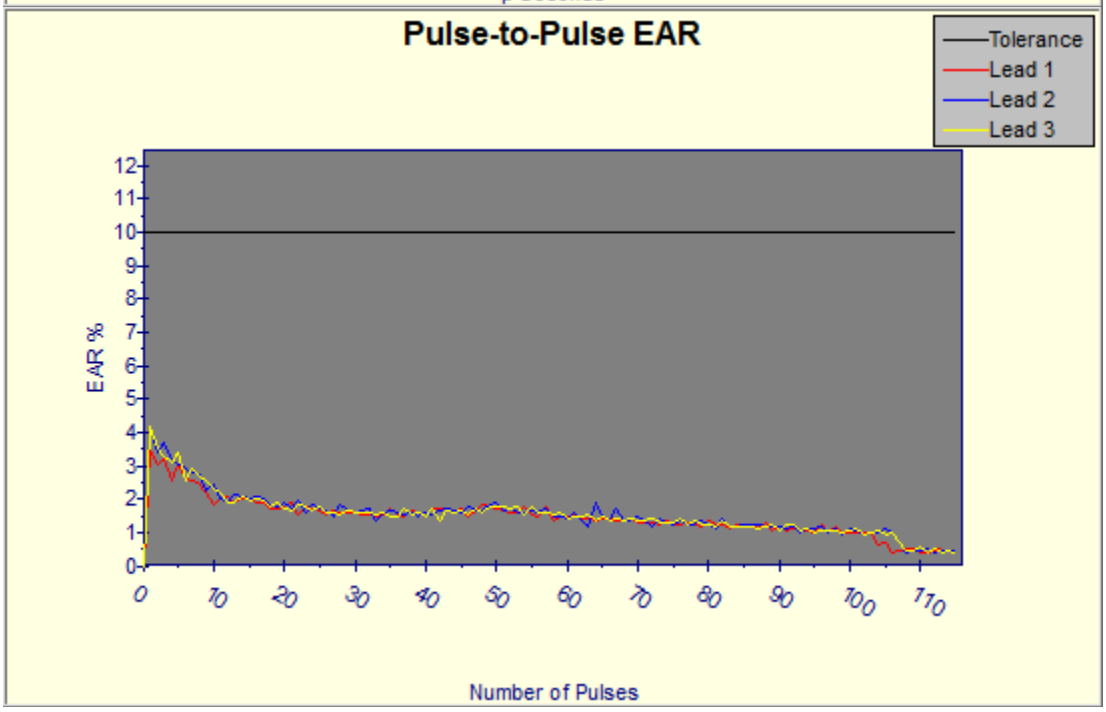




Pulse-to-Pulse EAR		Motor ID 1	
Test Date/Time	1/18/2013 11:07:45 AM	Surge Status	PASS

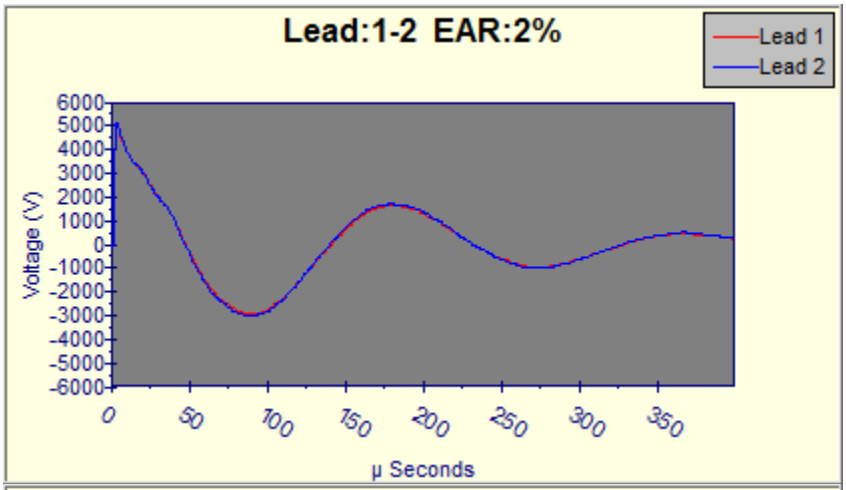
Lead	Peak Voltage (V)	PP EAR Status	Max P-P EAR(%)
1	5600	PASS	3.5
2	5600	PASS	4.2
3	5650	PASS	4.2

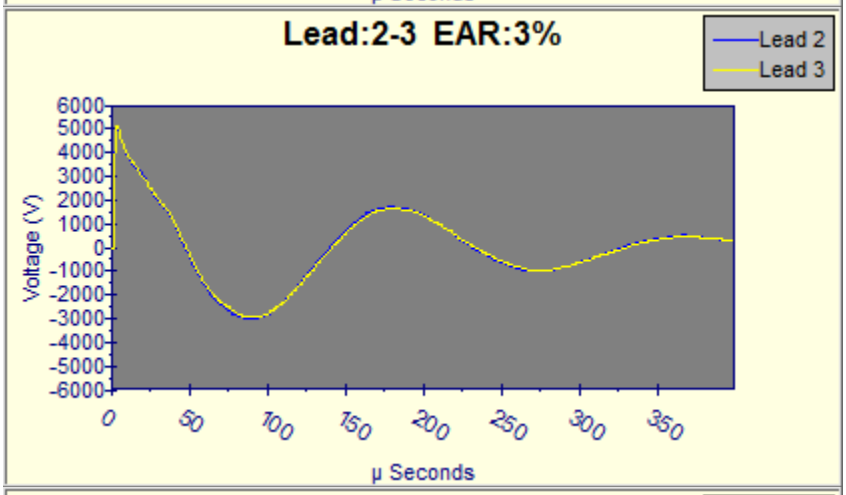


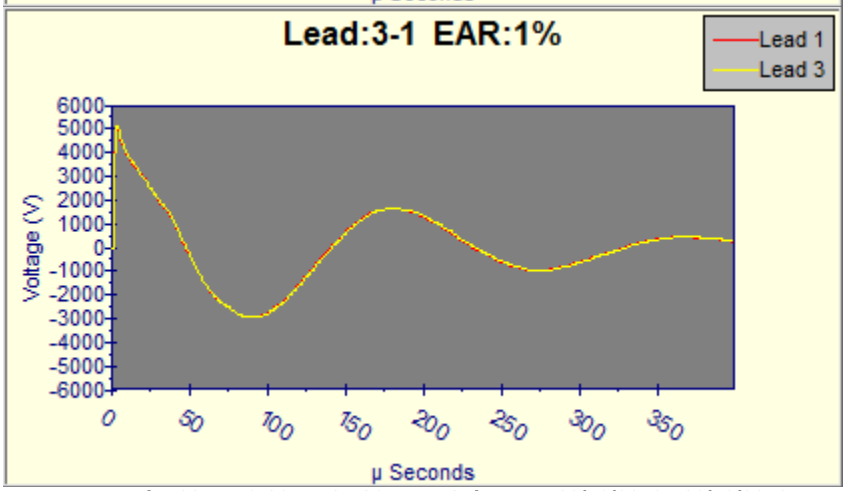


Surge Phase-to-Phase Comparison		Motor ID 1	
Test Date/Time	1/18/2013 11:07:45 AM	Surge Status	PASS

Compare	Peak Voltage (V)	LL EAR Status	L-L EAR%
1 - 2	5600	No Test	2
2 - 3	5600	No Test	3
3 - 1	5650	No Test	1







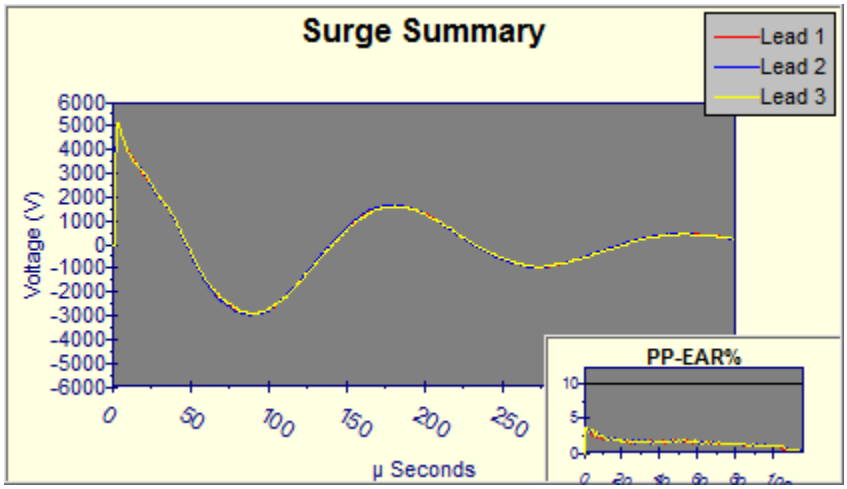
Tester Info: 99-A412-00E T-01-06; 457; Cal Dates: 09/12/2012 - 09/12/2013

Results Summary Log

Motor ID	Time	Temp	Resist	Megohm	DA/PI	DC	Surge
2	1/18/2013 10:20:43 AM	Tested	PASS	PASS	PASS	--	PASS

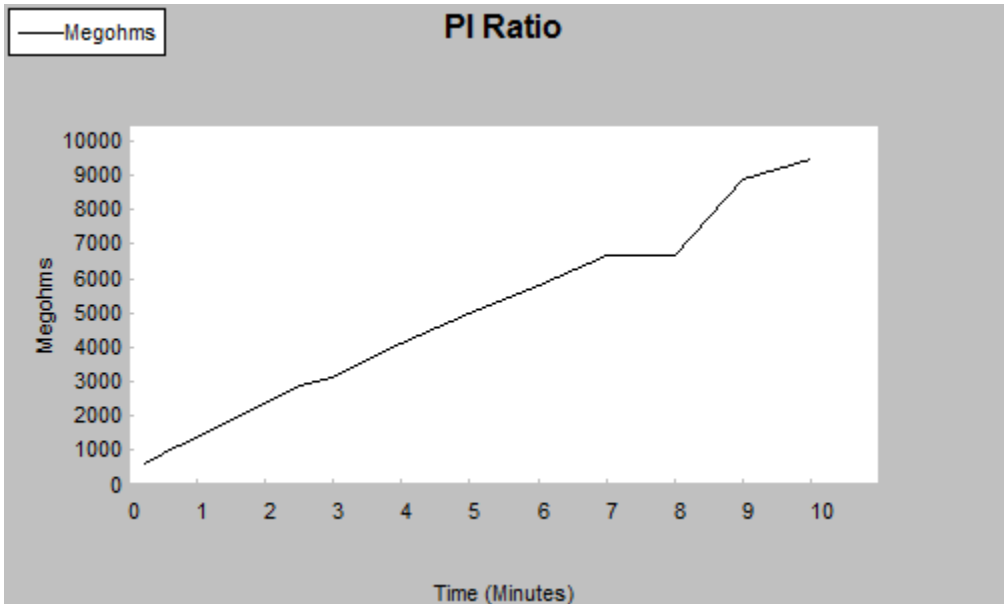
Nameplate Information		Motor ID 2	
Location	City of Richland Hills	Building	Pump Station
Model		Manufacturer	GE
Serial Number		HP/KW	250
Volts-Rating	2300	Volts-Operating	2300
Amps-Rating	63.5	Amps-Operating	63.5
Insulation		Enclosure	
RPM	705	Service Factor	0
Frame		Freq-Hz	60
LR Code		LR Amps	0
NEMA Design		Max Amb °C	0
NEMA nom eff	0	Duty Cycle	
Manuf's Type		Manuf Dt Cd	
Descrition	250hp AC motor		

Results Summary		Test Date/Time 1/18/2013 10:20:43 AM	
Test ID:	2300V with PI	Repair/Job #	604096
Tested By		Tested For	
Room #		MCC	
Location	City of Richland Hills	Building	Pump Station
Temp Status	**Tested**	**PI Status**	**PASS**
Temp	14.0°C 57.2°F	Volts (V)	4000
Resist Status	**PASS**	DA Ratio	3.5
L1-L2 (Ohms)	0.750 Corr: 0.783	PI Ratio	7.0
L2-L3 (Ohms)	0.752 Corr: 0.785	**HiPot**	**No Test Performed**
L3-L1 (Ohms)	0.751 Corr: 0.784	Volts (V)	0
Max Delta R %	0.269	I(µA)	0
Coil 1 (Ohms)	0.374 Corr: 0.391	Resist (Mohm)	0
Coil 2 (Ohms)	0.376 Corr: 0.392	**Surge Status**	**PASS**
Coil 3 (Ohms)	0.376 Corr: 0.393	Peak Volt(V) L1	5600
Megohm Status	**PASS**	Peak Volt(V) L2	5600
Volts (V)	3990	Peak Volt(V) L3	5600
I(µA)	2.90	Max P-P EAR(%)	3.2/4.0/3.7
Resist (Mohm)	1376 At 40°C 226	EAR 1-2/2-3/3-1(%)	No Test



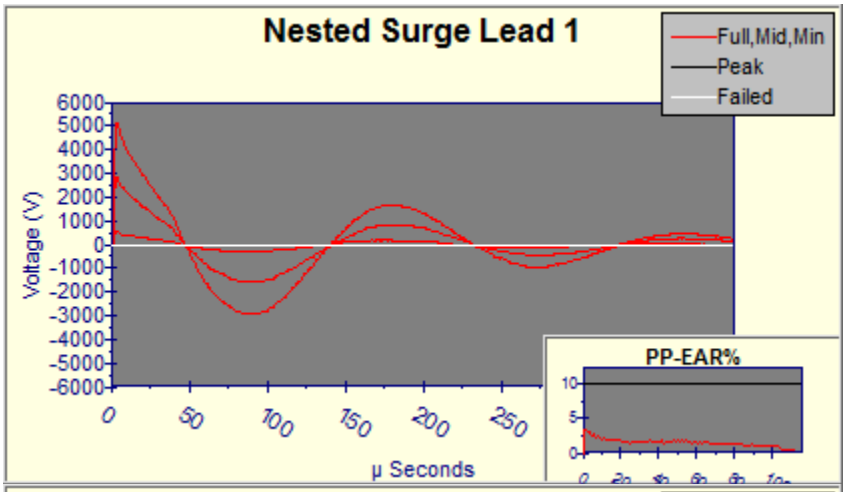
DA/PI		Motor ID 2	
Test Date/Time	1/18/2013 10:20:43 AM	Voltage (V)	4000
DA Ratio	3.5	PI Ratio	7.0
PI Status	PASS		

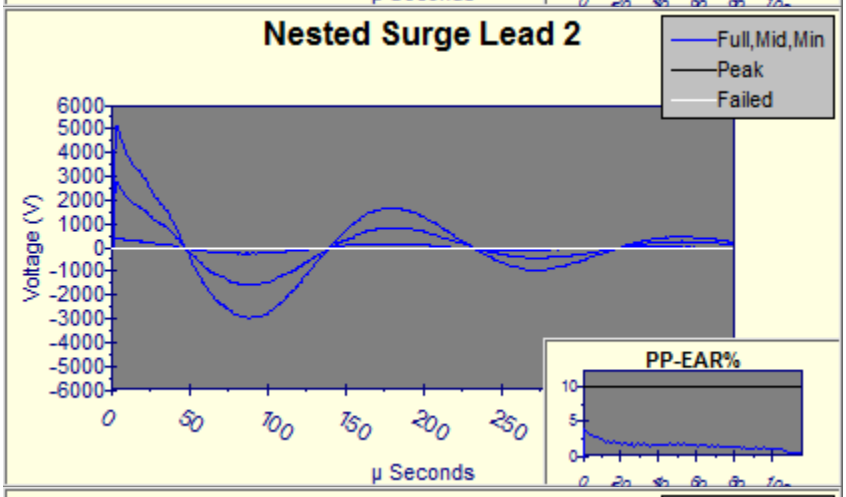
Time (Min)	I(µA)	Megohms
0:15	6.24	641
0:30	4.46	896
0:45	3.50	1140
1:00	2.92	1369
1:30	2.09	1913
2:00	1.70	2347
2:30	1.39	2870
3:00	1.29	3100
4:00	0.97	4123
5:00	0.80	5000
6:00	0.69	5797
7:00	0.60	6666
8:00	0.60	6666
9:00	0.45	8888
10:00	0.42	9500

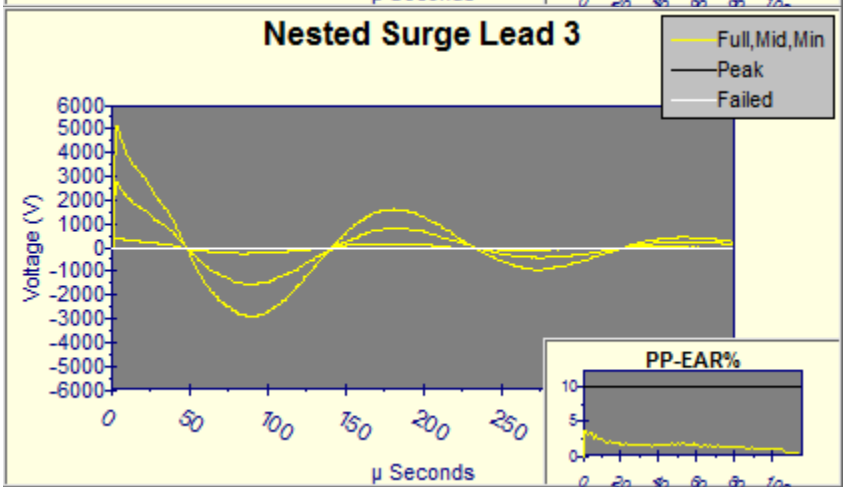


Surge: Nested Waveforms		Motor ID 2	
Test Date/Time	1/18/2013 10:20:43 AM	Surge Status	PASS

Lead	Peak Voltage (V)	PP EAR Status	Max P-P EAR(%)
1	5600	PASS	3.2
2	5600	PASS	4.0
3	5600	PASS	3.7

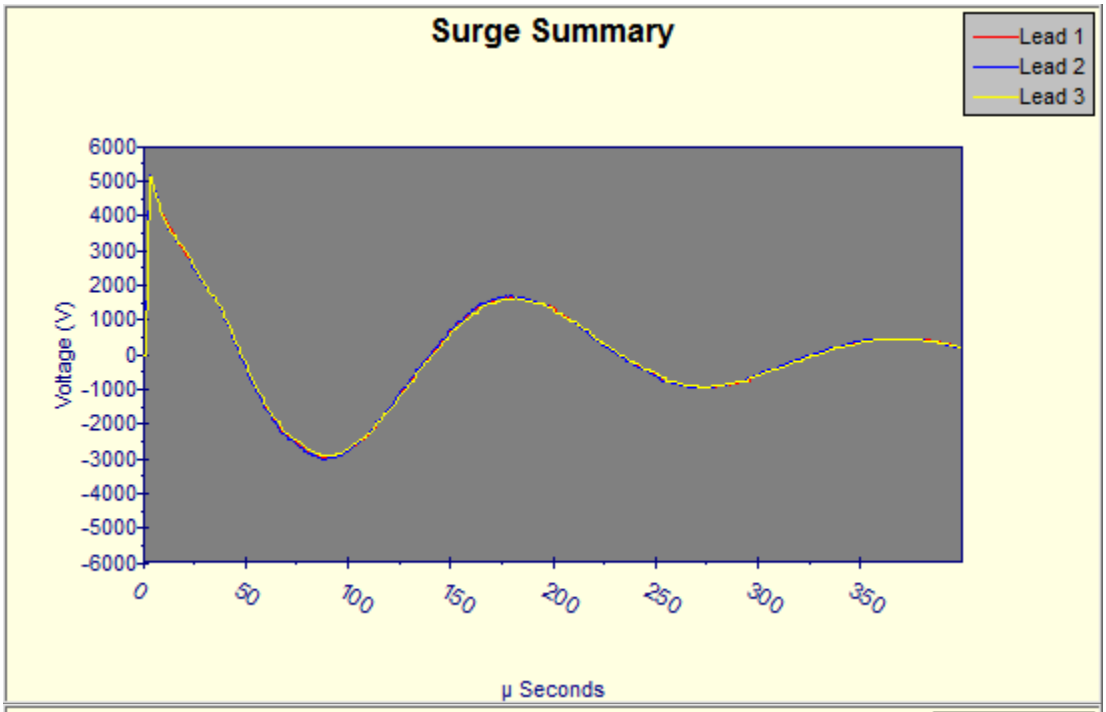


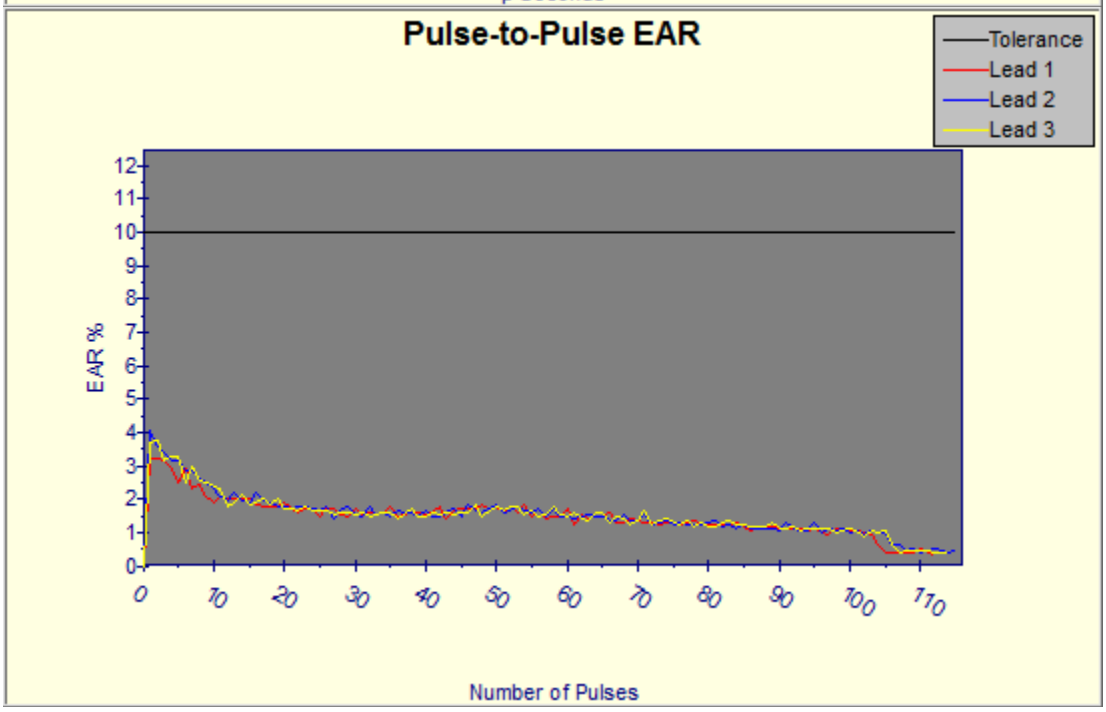




Pulse-to-Pulse EAR		Motor ID 2	
Test Date/Time	1/18/2013 10:20:43 AM	Surge Status	PASS

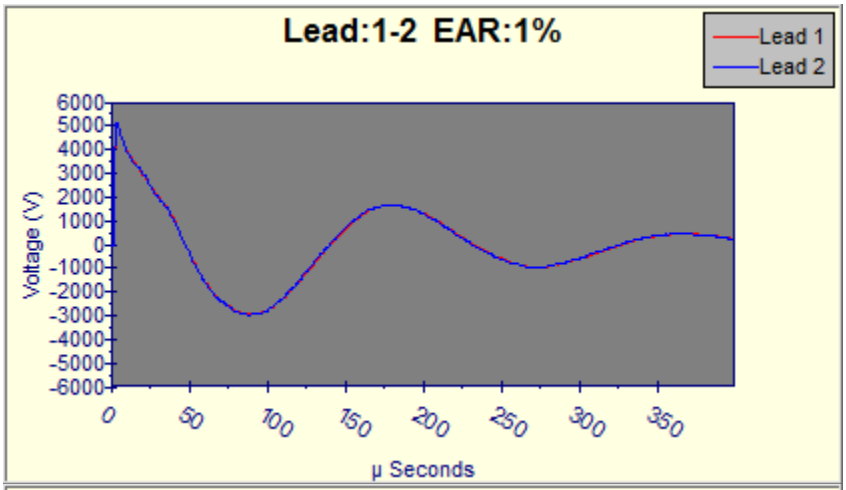
Lead	Peak Voltage (V)	PP EAR Status	Max P-P EAR(%)
1	5600	PASS	3.2
2	5600	PASS	4.0
3	5600	PASS	3.7

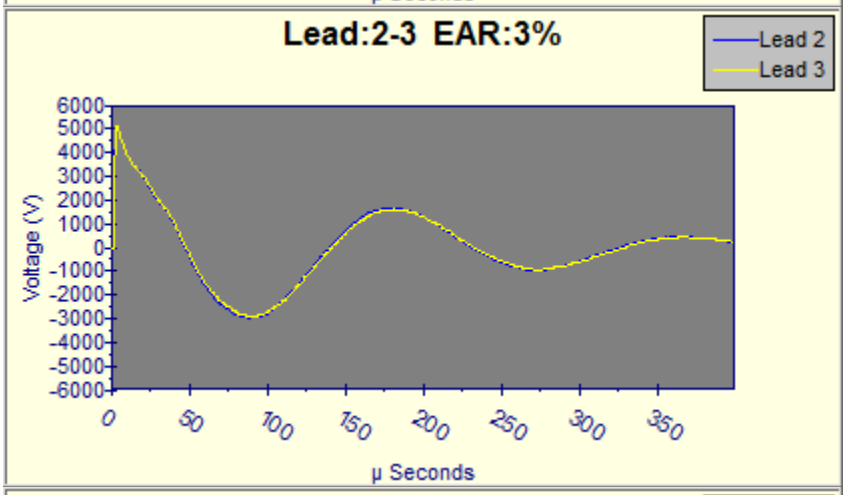


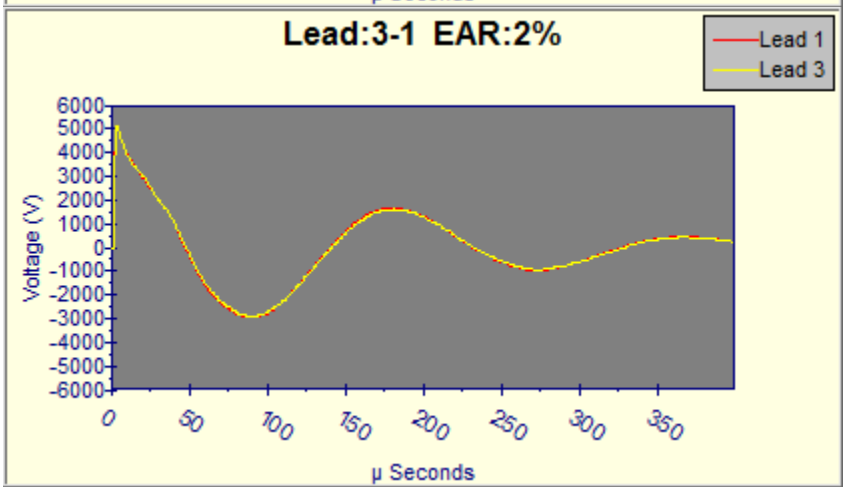


Surge Phase-to-Phase Comparison		Motor ID 2	
Test Date/Time	1/18/2013 10:20:43 AM	Surge Status	PASS

Compare	Peak Voltage (V)	LL EAR Status	L-L EAR%
1 - 2	5600	No Test	1
2 - 3	5600	No Test	3
3 - 1	5600	No Test	2







Shermco industries®

One Line. One Company.®

Customer: City of Richland Hills

Location: Pump House Building

Shermco Project No.: 208387

Description: Investigation of the Pump House Switchgear

Date: January 18, 2013

Work Performed and Report Prepared By:
Shermco Industries
Corporate Headquarters | Dallas Service Center
2425 E. Pioneer Dr., Irving, TX 75061

Appendix C

Shermco industries

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March 29, 2013

Mr. Michael Barnes
City of Richland Hills
3200 Diana Drive
Richland Hills, TX 76118

Subject: **Investigation of the Pump House Switchgear**
Shermco Project No.: 208387

Location: **Pump House Building**
Richland Hills, Texas

Dear Mr. Barnes:

On January 18, 2013, Shermco Industries performed an investigation of the switchgear for the City of Richland Hills at the Pump House Building located in Richland Hills, Texas.

Shermco recommends the switchgear be replaced with a fused air switch, two vacuum contactors, and motor protection relays. This system could be designed for remote operation of the pump motors.

The existing gear should have the following maintenance performed;

- The Batteries should be tested for specific gravity and distilled water should be added. The connections should also be cleaned of corrosion.
- The station service fuses should be inspected and contact resistance testing performed.
- Test 9 Overcurrent relays G.E. IAC53B2A
- Test 4 Thermal Overcurrent relays G.E. 12TMC12B104
- Test 2 Undervoltage relays G.E. 12IAV54E1A
- Replace the connections on the 6 heaters, because the switchboard wiring has become brittle and the insulation is falling off.
- Perform insulation resistance testing & Transformer turns ratio testing on the “control power transformer” C.P.T.
- Perform insulation resistance testing & Transformer turns ratio testing on the 3 “potential transformers” .P.T.’s.
- The 3 Breakers should be cleaned & the operating mechanisms should be lubricated.
    - The oil currently in each breaker should be tested for its dielectric strength.
    - The oil level is low and should be replenished. (About 2 gallons per breaker).
    - I would not recommend disconnecting the breaker from the bus connections, there exists a possibly of damaging the bushings.

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- o Contact resistance testing could be performed from the line side of the main breaker to each load side of the two pump motors.
- The common bus should be tested for insulation resistance.

Thank you for the opportunity to be of service. Should you have any questions or require additional information or services, please do not hesitate to contact us. We are available 24 hours a day, seven days a week.

Respectfully submitted,
Shermco Industries
Dallas Service Center

Michael D. Kennedy

Mike Kennedy
Field Service Technician
Engineering Services Division