NWL Power Systems

PRODUCT MANUAL

(for OEMs & END USERS)
FOR 3/2 OIL PROCESSING POWER SUPPLIES

Manufactured By:

NWL
312 Rising Sun Rd.
Bordentown, NJ 08505 USA
(609) 298-7300
(www.nwl.com)

NWL Oil Processing Power Supplies are an industry standard for stable, reliable power in this field. More of them may be in service at the moment than the power supplies of any other manufacturer.

SERVICE
Skilled factory service personnel are available for your needs simply by calling NWL at 609-298-7300 any business day from 8 AM to 5 PM, Eastern time.

EMERGENCY ACTION
At time of delivery, the product should be carefully inspected. Any damage, leakage, etc. should be noted on the shipping memorandum. A damage claim should be filed with the transportation company immediately.
NWL should be notified by calling (609)298-7300.

Repair and servicing of the equipment should be performed by a qualified NWL representative.
OPENING OF THE LID OR HAND-HOLE COVER WILL VOID WARRANTY UNLESS AUTHORIZED BY NWL.

After delivery but prior to installation, if any leakage is noted, please call NWL immediately.

On or after installation, if unit malfunctions, remove all power and call NWL immediately.

WARNING! High Voltage!

NWL power supplies contain dangerous and potentially lethal voltages.

- Do not attempt to service the device while it is powered up or operating.
- Turn off power to unit and carefully follow the grounding procedures described within this manual before doing any physical or electrical work on the unit.
- Take precautions against shock or electrocution
- Do not stand in water or on damp surfaces while working on the unit.
- NWL will not be liable for death, injury or damages resulting from the unsafe installation or operation of this device.
- "DANGER! - To reduce the risk of Electrical Shock, Carefully follow the instructions within this manual.

These are Important Safety Instructions

SAVE THESE INSTRUCTIONS!

EQUIPMENT COVERED BY THIS MANUAL IS ENERGIZED BY EXTERNAL SOURCES AND CONTAINS HAZARDOUS VOLTAGES. INCOMING POWER MUST BE REMOVED BEFORE ENTERING OR SERVICING THE EQUIPMENT. ONLY AUTHORIZED AND TRAINED PERSONNEL ARE TO OPEN, OPERATE OR MAINTAIN THIS EQUIPMENT.

NWL – PERFORMANCE AND RELIABILITY

NWL specializes in the design and manufacturing of power supplies and components for a variety of end uses. It's the kind of company you didn't think existed anymore: customer-responsive, market-driven and experienced in all areas of power technology. We also maintain a degree of control over our products which is unusual in today's "built elsewhere, assembled here" environment. We develop, design, manufacture, distribute and support all our products from start to finish. As a result, you can be sure that all components are compatible...that design integrity has been preserved ...and that one high standard of quality prevails throughout — ours.

It also means that, if you need support of our product or require adaptation to your specific needs, we will have the answers. And, with over sixty years of experience in creating components and power supplies for a broad range of industries, you'll also get the benefit of proven techniques which we adapt from one market to another

That's all part of our commitment to providing a total solution that meets or exceeds the needs of the systems integrators, OEMs and end-users who look to us for innovation with solid reliability.

Table of Contents

1
INTRODUCTION TO OIL PROCESSING POWER SUPPLIES

NWL offers a standard range of specific AC to AC and AC to DC, 100% reactance power supplies to meet the demanding needs of the oil processing market. Among this family of power supplies is a 3 phase to 2 phase transformer also known as a "Scott T". The 3-2 phase transformer product is presently offered in KVA sizes from 50 KVA through 400 KVA. This 3-2phase power supply is also designed with 100% internal reactance and offers a range of output voltages from 12KVAC to 25KVAC via a tap selection switch for easy selection. All NWL oil processing power supplies are designed to be used within Class1, Division II Hazardous Locations.

This 3-2 phase designs can accept most common primary input voltages (is.380/400/415/460/480/600/690 VAC, 3PH, 50/60Hz) into three feed-through bushings within an IP 66 Rated (Nema 4) junction box mounted to the side of the oil tank. Other voltages may also be available upon special request (consult factory). The primary voltage is stepped up to a higher AC voltage using two single phase step-up transformers. The primary windings of these two transformers are wired together in a configuration that is designed to accept 3 phase power. The secondary of each of these transformers is wired independently from each other allowing for two separate high voltage outputs, each with respect to ground. (see the transformer nameplate/electrical schematic for a representation of this configuration). One end of the secondary of the transformer is grounded to the oil tank and the high voltage that is present on the other end of the winding is fed through a high voltage bushing into a flanged HV bushing on the side of the main oil tank where the customer will make their connection. Located on the side of the tank are two 5 position taps switched. These switches are wired directly into the secondary windings of the transformer. Adjustment of these switches provides 5 different output voltages between 12Kvac – 25Kvac.

This power supply is equipped with 100% reactance current limiting reactors. This means that the primary and secondary currents are limited to 100% of their nameplate ratings. This is achieved through the use of three current limiting reactors that are within the oil tank. These reactors are wired between the input

power lines and the primary of the step-up transformers where they limit the input current to the primary of the transformers.

Standard features on this unit include the following:

Pressure relief valve on the main tank
Oil level gauge on the main tank
Lower drain valve on the main tank
Temperature gauge on the main tank
An internal temperature switch on the transformers
An Ex. rated pressure switch on the main tank
An Ex. temperature pressure switch on the main tank

The customer can monitor the primary current of the unit through three current feedback signals provided at a terminal strip within the primary junction box. The feedback is derived from three CTs (current transformer) within the main tank. Each CT will provide a 0-5AAC feedback signal proportional to the size of the CT. (see the chart on the following pages CT identification within each different unit).

The customer can also monitor the output voltage through means of a proportional voltage feedback signal also at the junction box terminal strip. This proportional signal is derived from a tertiary winding within the windings of each of the transformers and will provide a 0-100vac feedback signal proportional to the full input and output AC ratings of the power supply. Both of the tertiary windings in this unit are wired together in series before they are brought out to the junction box. Therefore, when both transformers are fully energized at their maximum voltages, the total feedback voltage at Y1 & Y2 in the junction box will be 100 x (2) = 200vac.

*****CAUTION***:**
THIS EQUIPMENT CONTAINS NO USER SERVICEABLE PARTS. ONLY AUTHORIZED SERVICE PERSONNEL ARE TO OPEN AND SERVICE THIS EQUIPMENT.

2

SHIPPING, RECEIVING, HANDLING AND STORAGE

Shipping and Receiving

NWL Power Supplies are shipped on heavy-duty pallets and covered with plastic envelopes for protection, unless otherwise specified. The transportation means used will be suitable for equipment containing high voltage electronic gear.

As with all high voltage equipment, handling is critical so that the internal clearances, the integrity of the high voltage bushings, if any, and the dielectric coolant are not injured or compromised.

The equipment should be examined as soon as it is received. Be sure that:

- The fluid level registers between the limits indicated on the liquid level gauge, and

- That the plastic envelope has remained intact.

Remember, any external damage may be an indication of internal damage.

Handling:

The unit can be removed from the truck with a forklift. Channels are provided on the bottom to facilitate the use of a forklift when the pallet is removed. Four lifting lugs have been provided at the four corners of the tank for overhead lifting by crane or hoist.

Whatever the removal method, your unit has high voltage bushings. Take care not to bear any force on them.

Use spreaders on slings, if necessary, and provide padding to protect the painted surfaces from the sling.

NOTE: **When handling the equipment without its pallet, take special care of the side radiators, as they are thin-walled for efficient heat-transfer and their repair requires special welding equipment not available in the field.**

Storage:
If the equipment cannot be installed soon after its arrival, follow these procedures:

- Store it in a clean dry place sheltered from the elements.

- Maintain the equipment on its shipping pallet and with its plastic envelope intact to minimize damage to the radiators and external gauges. This will also tend to discourage pilfering.

- Should the pressure relief valve be damaged, disassembled, or removed, apply an airtight seal immediately upon discovery and notify NWL at (609) 298-7300, otherwise the warranty will be voided.

The temperature of the storage area must be maintained between -40C and 60C (-40F to 140F). If the temperature of the storage area is below -20C (-4F), it is recommended that the oil be heated prior to applying full rated input voltage to the Power Supply. Simply operate the Power Supply at 1/3 rated input voltage until the temperature gauge on the Power Supply registers 0C or higher.

3

Symbols & Warning Labels

SYMBOLS:

The following symbols are used throughout the power supply. They mean the following:

This symbol means that CAUTION needs to be exercised and that the user should refer back to the manual for accompanying information.

This symbol means that there is a PROTECTIVE CONDUCTOR TERMINAL located at that spot and can be found adjacent to all protective earth terminals in the unit.

WARNING LABELS:

Warning Labels have been placed on your new equipment. If these labels become worn and need to be replaced, they can be obtained from our factory. The labels are as follows:

Label #1: Green Safety Instruction Label (NWLPart#M40015):

This label should be placed on T/R-set low voltage junction box covers.

Label #2: Danger Label (NWL Part #M40016):

This label should be placed on any removable high voltage access covers such as the external switch access panel.

4

MAIN POWER SUPPLY COMPONENTS

1. H.V. Transformers:
The two main transformers step up the primary input voltage to the level required for the desired output. The secondary of the transformers utilize "belly" taps in order to provide the user with five different high voltage output levels to choose from. One end of each of the HV secondary windings is tied directly to ground thus allowing the HV output power to always be with respect to ground.

2. Reactor:
The three reactors within this product are sized so as to provide 100% reactance to the primary of the system. This allows the reactor to drop the full primary voltage across its coil when the transformers draw full current through it. This component inhibits the power supply from ever pulling more than rated primary current.

3. Tap Switch:
Two NO-LOAD tap switches are located within the main tank of the power supply. The operating handle is located on the side of the tank. These tap switches provides the user with the ability to choose from five different output voltages. The switch is designed to be operated with the power off.

4. Fuse:
A fuse is provided within the low voltage junction box. This fuse provides protection to the tertiary windings within the transformer from overload due to a short in the feedback wiring to the customer interface terminals, also located in the junction box. The fuse is rated at 1.25A. This special fuse is designed specifically for use in a Div I, Class II Ex environment. *****IMPORTANT: DO NOT REPLACE THIS FUSE WITH ANYTHING OTHER THAN THE ORIGINAL EQUIPMENT. IF ANY OTHER FUSE IS USED, IT WILL VOID THE WARRANTEE AND VOID THE Ex ZONE CLASSIFICATION HELD BY THE POWER SUPPLY WHICH COULD LEAD TO AN EXPLOSION WITHIN THE ENVIRONMENT THAT THE EQUIPMENT IS BEING USED.**

5. Tank:
All components of the Power Supply are contained in a tank filled with a dielectric cooling fluid. Generally, this fluid is a transformer grade mineral oil. Check the nameplate on the exterior of the tank wall or the specification sheet in the back of this manual to determine the manufacturer and type of oil which has been furnished in your unit. These oils contain no PCBs.

Access for inspections and field servicing of the unit is through the lid on top of the main tank and the lid of the aux. output tank (if provided).

Your Power Supply is also equipped with:

- A stainless steel 0.5-13 threaded Ground Pad located on the side of the tank for tank grounding purposes.

- A Pressure Relief Valve, factory set for 2 PSI, to relieve excess pressure in the tank, if needed.

- A Temperature Gauge, calibrated to give proper top oil temperature.

- A Liquid Level Gauge which shows oil level in the tank at 25C.

5

UNIT RATINGS

The rating for your power unit would be as follows:

Input:
150 KVA
400vac, 3Phase, 50 Hz
216.5 aac

Output:
This unit has two HV outputs. Each output is respect to chassis ground. Five output voltages can be selected through a NO-LOAD (5) position tap selector switch that can be accessed from the side of the unit. The selection of nominal AC output voltages are as follows:

12KVAC
16.5KVAC
20KVAC
23KVAC
25KVAC

$\pm$ 5% depending on input voltage

Both tertiary windings are rated 100V nominal @ 2 amps $\pm$5% output. Actual tertiary voltage will be dependent upon actual input voltage to its corresponding transformer and will range from 0V – 100V. Since both tertiary windings from the two transformers are wired in series within the unit, the total feedback from the voltage feedback circuit will range from 0-200vac.

The three current transformers used within this unit are as follows:

UNIT SIZE		**CT USED on 50HZ Unit**
150KVA	-----	250:5

6

APPLICABLE STANDARDS

This oil processing power supply has been designed and built to comply with standards required for Group II, Zones 1 or 2 Explosion Proof areas. The unit is designed to meet standards of following notified bodies:

IEC (ATEX)
UL
CSA

UL 60079-0, 60079-6, 60079-7
CSA E60079-0, E60079-6, E60079-7
IEC EN 60079-0, EN 60079-1, EN 60079-6, EN 60079-7

* Check the specification supplement within this manual and/or the nameplate to determine if your unit is certified to a notified body.

7
DIELECTRIC FLUID

This power supply contain a dielectric fluid for cooling and voltage insulation. The fluid is a transformer grade mineral oil. This oil contains no PCBs. The type and quantity of fluid is specified on the label attached to the exterior tank wall. **It is imperative that the proper fluid level always be maintained so that the unit is properly cooled and that all high voltage parts remain under the oil so as to not compromise the Ex protection provided by the oil.** The oil level can be monitored via the liquid level gauge on the side of the tank. The gauge shows where the oil level should be at 25 Degrees C. This gauge should be periodically checked to verify oil level. **The minimum permissible oil level of these units is defined as 1.75" below the marked level inside the tank. This is equivalent to the "LOW" mark on the liquid level gauge.**

1. Filling Instructions:
The unit is properly filled and processed at time of construction. Unless the oil is drained during installation, there should be no need to add oil to the unit. If small amounts of oil need to be added to the unit to bring it up to the fill point, the oil can be introduced through the pressure relief valve opening without having to remove the entire lid. If work has been performed to the unit whereas the lid has been removed, oil can be pumped or poured directly into top of the unit. The oil level should never be lowered lower than to the top of the main transformer coils. If the oil level has been drained lower than to top of the coils or if excessive air bubbles are present after refilling, the unit should be run for 8 hrs at 1/4 input power so as to heat up the unit and allow the air bubbles to work their way to the top while the output voltage remains low.

2. Lid Torque specifications:
If the lid has been removed to either fill the unit with oil or maintain the unit in some other capacity, the lid clamping brackets need to be properly tightened to a specific torque spec. when reassembled. The lid clamping bolts should be tightened as follows:

a) Hand tighten all lid clamps.
b) Tighten all lid clamps to 240 in/Lbs in a criss cross pattern, from one side of the lid to the other, similar to that of tightening the wheel lugs on an automobile.

8

PRESSURE RELIEF VALVE

All NWL oil filled power supplies are equipped standard with an automatic pressure relief valve on the lid of the supply. This device is a safety feature that will permit the escape of any high pressure that may build up within the tank under adverse conditions. Such conditions could be excessive oil expansion due to extremely hot operating conditions due to extremely hot ambient temperatures. The pressure relief valve is designed to open at 2 PSIG.

9

THERMAL PROTECTION SWITCH

All units contain an internal thermal switch. This is a normally closed bi-metallic switch that will open on an over-temperature rise. The switch is potted within the primary of the main transformer. It is there as a protection means in the unlikely event that the unit overheats. It is designed to open at 88 degrees Celsius. Consult the specification sheet within this manual for the contact ratings of this switch.

The switch contacts are brought out to junction box and terminated to the terminal strip. They are labeled T1 & T2. The customer is responsible for using this feedback signal to monitor an over-temperature condition.

10

LIQUID LEVEL SWITCH OPTION & REQUIREMENTS

Some units may be equipped with internal liquid level switches to detect a loss or insufficient amount of oil inside the tank. On these units, if the oil falls below the minimum permissible level allowed, the internal liquid level switches will open and indicate the alarm. Units that are equipped with this option contain two switches. One switch is in the main tank and the other is in the auxiliary diode box. Both of these switches are wires in series and brought out to the LV junction box for interfacing with the user.

****To determine if your unit has internal liquid level switches, please refer to the nameplate where the switches will be indicated if present.****

If the user decides to use the internal liquid level switch option, it is imperative that the power delivered to the switches be provided using an intrinsic safety barrier. The reason for this is because if there is a loss of oil, the switches used inside the unit would no longer be protected from the hazardous location via oil immersion. Therefore, a barrier must always be in place to limit the voltage and current to the switches to limit the energy available that could cause ignition of any present gasses.

The minimum requirements on the barrier that can be used on this equipment to comply with the certification held by the unit are outlined in the drawing on the following page (figure B). Wiring instructions are also include on this drawing.

The two switches inside the unit are wired in the Normally Closed state when oil is at the proper level. The switches will open on loss of oil.

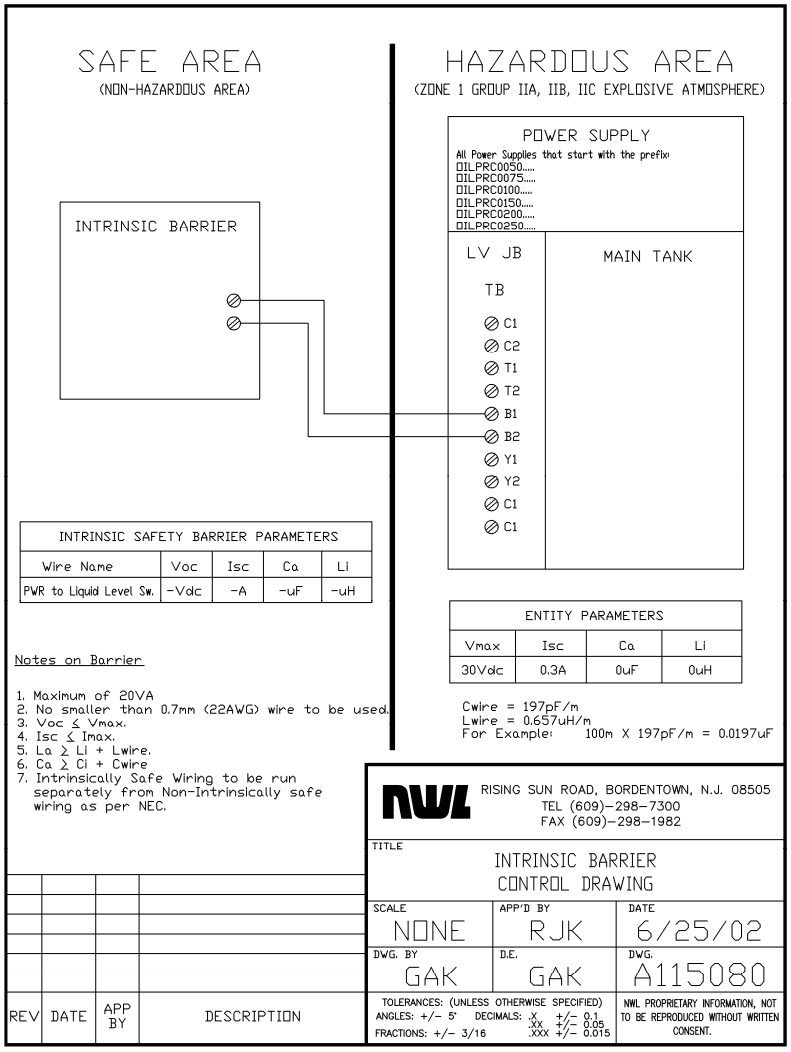
SAFE AREA
(NON-HAZARDOUS AREA)
HAZARDOUS AREA
(ZONE 1 GROUP IIA, IIB, IIC EXPLOSIVE ATMOSPHERE)
POWER SUPPLY
All Power Supplies that start with the prefix:
DILPRC0050.....
DILPRC0075.....
DILPRC0100.....
DILPRC0150.....
DILPRC0200.....
DILPRC0250.....
INTRINSIC BARRIER
LV JB
TB
C1
C2
T1
T2
B1
B2
Y1
Y2
C1
C1
MAIN TANK
INTRINSIC SAFETY BARRIER PARAMETERS
Wire Name | Voc | Isc | Ca | Li
PWR to Liquid Level Sw. | -Vdc | -A | -uF | -uH
ENTITY PARAMETERS
Vmax | Isc | Ca | Li
30Vdc | 0.3A | 0uF | 0uH
Notes on Barrier
1. Maximum of 20VA
2. No smaller than 0.7mm (22AWG) wire to be used.
3. Voc ≤ Vmax.
4. Isc ≤ Imax.
5. La ≥ Li + Lwire.
6. Ca ≥ Ci + Cwire
7. Intrinsically Safe Wiring to be run separately from Non-Intrinsically safe wiring as per NEC.
Cwire = 197pF/m
Lwire = 0.657uH/m
For Example: 100m X 197pF/m = 0.0197uF
RISING SUN ROAD, BORDENTOWN, N.J. 08505
TEL (609)-298-7300
FAX (609)-298-1982
TITLE
INTRINSIC BARRIER
CONTROL DRAWING
SCALE NONE
APP'D BY RJK
DATE 6/25/02
DWG. BY GAK
D.E. GAK
DWG. A115080
REV | DATE | APP BY | DESCRIPTION
TOLERANCES: (UNLESS OTHERWISE SPECIFIED)
ANGLES: +/- 5° DECIMALS: .X +/- 0.1 .XX +/- 0.05 .XXX +/- 0.015
FRACTIONS: +/- 3/16
NWL PROPRIETARY INFORMATION, NOT TO BE REPRODUCED WITHOUT WRITTEN CONSENT.
FILENAME=N:/PROJECTS/ACADMAG/MATCD/A115080.DWG

Figure B.

11

FINISH

NWL offers three exterior finishes. Two are paint finishes and the other is the bare finish of the stainless steel offered on units constructed with stainless steel material.

The first of the two paint finishes is our NWL WP system using an industry standard ASA61 gray pained finish. This two component paint system is a high quality outdoor paint system that has been used by NWL successfully for more than 25 years in various outdoor environments ranging from smelting to petrochemical operations.

Following the hot phosphatized surface treatment is a primer which is free of environmentally unacceptable chromates or lead salts. An alkyd enamel topcoat completes this paint system.

NWL WP consists of an iron phosphate secondary pretreatment over pickled and oiled steel followed by 1.5 to 1.8 mils dry film thickness (DFT) of primer and 3.0 to 5.0 mils DFT of an industrial alkyd topcoat. NWL's standard color for these power supplies is ASA 61 light gray.

SSPC standards that are met or exceeded include SP-8 and PT-4-64.

The second of the two paint finishes offered is NWL's Megatran 50 system. This three-step paint system is one of the best systems offered today and is used in the most severe and corrosive environments that exist today.

A self-healing inorganic zinc-rich primer is followed by a high build epoxy primer. On top of these two layers is added an aliphatic polyurethane coating which offers additional protection as follows:

1. The polyurethane topcoat imparts superior resistance to not only acid and solvents but also caustics.

2. Since the second coat of epoxy is affected by ultraviolet radiation which causes chalking, the polyurethane topcoat is used to shield the epoxy and thus retard the chalking process.

3. Being an extremely tough film, this third coat affords extra overall resistance to corrosion and scratching.

To insure proper bonding, this three-part paint system is applied to steel that has been grit blasted to a "white-metal" finish (defined as the removal of all visible rust, mill scale, paint and foreign matter).

Typical applications for this top-of-the-line paint system include the following:

- Highly corrosive environments where organic solvents and acids come into contact with paint surfaces.
- Corrosive caustic environments.
- Salt water atmospheres.
- Corrosive mineral dusts.

This system is not designed for "cosmetics" but rather for high performances in severely corrosive atmospheres.

Specifications:

The paint system consists of an inorganic zinc primer of 2.5 mils minimum dry film thickness (DFT) followed by a high build epoxy primer, 4.0 to 6.0 mils DFT, and a topcoat of an aliphatic polyurethane, 2.0 to 3.0 mils DFT, imparting superior acid, caustic and solvent resistance. The total paint film thickness ranges from 6 mils minimum up to 8 mils DFT. The steel surface is grit blasted to a "white-metal" finish.

SSPC standards that are met or exceeded include SP-8, SP-10, SP-5, and PS-12.00.

Stainless Steel tanks are excellent with respect to general corrosion resistance, particularly in salt water environments (e.g. off-shore platforms). Resistance to organic solvents caustics and most acids make this a desirable product for some of the harshest of environments. Of the two standard stainless offered by NWL, 304 is the most commonly used.

12

INSTALLATION

1. Verify the rating

• The maximum fault capability of the power system at the point of installation should be verified and must not exceed the short-circuit rating of the unit. (same as nameplate current rating for these 100% reactance units)

• Do not exceed the ratings specified on the unit nameplate or system accessories.

2. Check the location

• Accessibility, ventilation, and ease of inspection should be given careful consideration in the location of a transformer

• Check installation area overhead for plumbing condensation, sprinklers or similar possible sources of trouble.

•A clearance of 1/2 inch should be provided between a wall and the rear of the unit for indoor equipment, when rear access is not required

• If rear access is required in either environment, a minimum of 30 inches should be provided.

• Transformers should always be separated from one another and from adjacent walls, partitions, etc., in order to permit free circulation of air about the tanks.

3. Check Area Conditions

• The equipment should not be exposed to standing water, abnormal vibration, shock, tilting, or other abnormal operating conditions.

• The temperature of the ambient air surrounding the power supply should be between the limits of -40C (-40F) and +55C (131F).

NOTE: Temperature or altitude conditions outside of the usual limits may require de-rating the unit or additional special equipment, such as heating, cooling or ventilation.

4. Prepare the site

• The floor beneath the unit must be level so that the tank is not distorted when bolted in place.
• Ensure the equipment adequately clears any underground raceways or cables.

5. Mount the unit

This is heavy equipment and must be securely anchored to prevent tipping over. Various methods may be used to anchor the unit to the foundation, including expandable inserts or "J" bolts embedded in concrete. The recommended size for anchor bolts is ½" – 13 UNC.
• The unit should be leveled and firmly secured to its supporting foundation. Steel shims may be used for final leveling if necessary.
• Follow the equipment outline drawings to determine the location of the mounting bolt holes and conduit locations.

6. Grounding

The unit must be grounded in accordance with the user's Local and National electrical codes before making any incoming power connection. If a main ground bus is furnished, make the ground connection to this bus.
If there is no ground bus, all equipment should be connected in such a way as to ensure a continuous grounding path. There must not be a break in the ground wire connecting all equipment to earth ground, unless a ground bus is used as an extension of the wire. This would allow equipment to be removed without breaking the ground.

Special attention should be paid to:

• protection for operating personnel,
• protection of equipment itself, (i.e. such as ground fault relays, if used) and
• protection of sensitive transducers or electronic control devices.

a. The grounding electrode conductor (ground wire) must be sized in accordance with your local and national codes and should be run from the grounding electrode to the power supply's grounding bus or ground terminal.

b. Unless already done at the factory, a main bonding jumper should be installed from the incoming grounded connector bus (neutral) to the ground bus or designated grounding point. If a jumper is not furnished, one having a size in

accordance with your local and national codes should be used.

c. Steps (a) and (b) should effectively connect together the grounding electrode, the power supply frame, all outgoing equipment grounding conductors and the grounded neutral bus of the system.

d. No connection should be made to ground on the load side of any neutral disconnecting line or any sensor used for ground fault protection. No connections should be made between outgoing grounding connectors and the neutral.

Note that this is only a guide. There may be other Codes which apply to grounding. It is up to the installer to ensure that the unit meets all applicable codes.

7. Making Connections

Now that all preparations have been made, it's time to begin connecting your Power Supply to your other equipment.

• Cable or conduit wire entrance to the inside of the junction box can be made through any or all of the 1" or 3" NPT weld flanges provided at the sides of the junction box. Follow all applicable Ex. codes when operating within a designated Class 1, Div.2 area.

• Follow all applicable codes pertaining to installation of equipment for use within Explosively Hazardous areas if this equipment is to be used in such an area.

• The first step is to route cable and wire bundles that enter the enclosure to avoid interference with moving parts. Observe minimum ending radius for the type of cable used

• Then power cables should be braced and/or laced to withstand short circuit forces wherever such cables are unsupported.

• Power cables should be adequately sized to carry the full load current in accordance with your local and national code requirements, and have an adequate voltage rating.

• Cables should be dressed and terminated as appropriate to the voltage class and cable manufacturer's recommendations.

• Then, replace any access covers, barriers, partitions, etc. that were temporarily removed during installation.

Before proceeding with the installation, familiarize yourself with the electrical schematic included in this manual for exact configuration of this transformer.

• The user must install a Circuit Breaker inline with the power supply. This circuit breaker should be rated for the amount specified in the Specification Sheet which is part of this manual. The instantaneous trip setting should be 10X rated and the interrupting current rating should be a minimum of 25KA at 400VAC.

• The main input lines should be connected to terminals L1, L2 and L3.

*****WHEN CONNECTING TO THE L1-L3 TERMINALS, BE SURE TO TIGHTEN THE TWO NUTS AGAINST EACH OTHER TO PREVENT OVER-TORQUEING THE STUD. FAILURE TO OBSERVE THIS PRECAUTION COULD CAUSE BREAKING OF THE CERAMIC BUSHING AND ALLOW OIL TO LEAK FROM THE TANK. FAILURE TO OBSERVE THIS METHOD WILL VOID THE WARRANTY.**

8. Making Output Connections

The output high voltage connections are to be made directly to the AC output bushings inside the pressure flanges provided on the side of the unit.

13

CURRENT TRANSFORMER (CT) CONNECTION

This unit is equipped with three current transformers mounted within the tank. Each CT monitors the primary current of the power supply. It provides the user with a 0-5AAC feedback signal proportional to the primary current. See the previous section to determine the electrical size of the CT within your unit. The size is also posted on the nameplate and schematic for your unit. All CTs are rated at 5VA.

With a VA rating of 5VA on the CT, the user can load the feedback signal with a **maximum** burden of **0.2**. This means that the total resistance of the device that the user is monitoring the current with, **including the resistance of the wire,** must not exceed **.2Ω.** The user can connect an ammeter to the feedback signal or any type of current monitoring device, such as a current transducer or transmitter. However, the user must have knowledge of the internal input impedance of the device. This way, the user can determine the minimum gauge of wire required for the length of run intended. If the run of wire is too long and/or the gauge of the wire is too light, the burden will exceed .2 and there will not be enough VA available to drive the monitoring device selected by the user.

The following two nomograms (Fig.1 & Fig.2) can be used to determine the 1) the maximum impedance (burden) allowed with respect to the VA of the CT and the maximum current that the CT will be running at, and 2) the maximum wire length allowed of a chosen wire size.

***** IMPORTANT*****
The unit is shipped with a shorting bar attached to the C1 & C2 terminations on the terminal strip within the junction box. This is done in order to prevent the terminals from developing a high voltage and sparking caused by the CT if it is not used and left open. If the user decides to use the CT feedback signal, the jumper must be removed when the customer's wiring is attached to the terminals.

BURDEN DETERMINATION

The Burden consists of the sum total of the wiring and all connected devices. Determine the burden of the connected devices by referring to the nameplate or catalog data. If the burden is expressed in volt-amperes, add this directly for the V.T., or convert to ohms impedance for the C.T., using Nomogram No. 1.

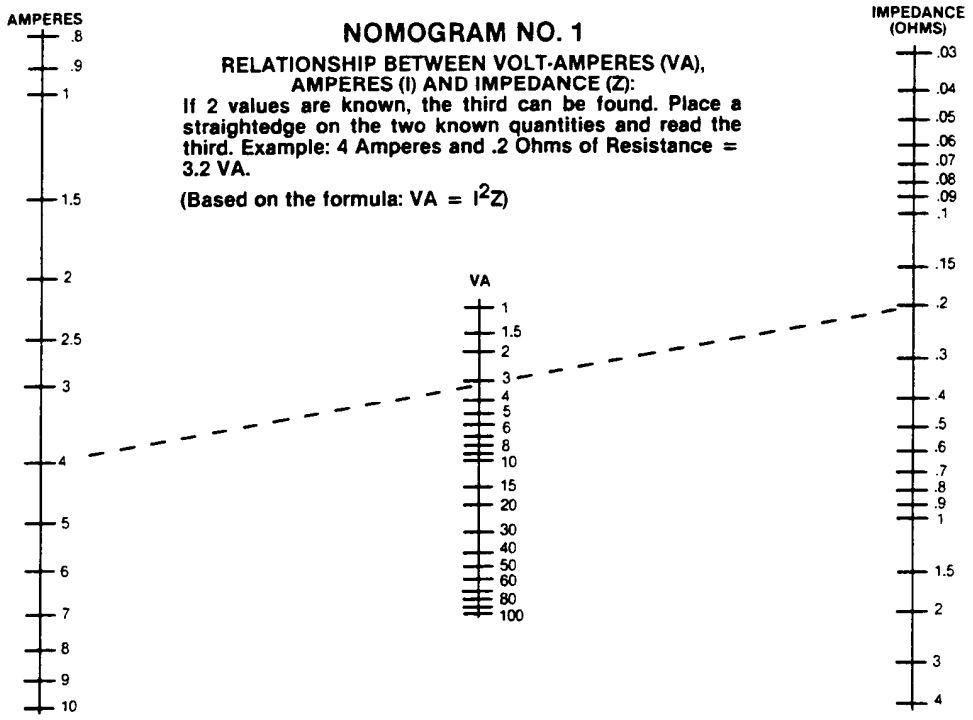

Fig.1

BURDEN DETERMINATION (continued)

Measure the length of the wire "run" between current transformer and the burden (e.g. meter, relay, transducer, etc.). Refer to Nomogram No. 2 and determine the resistance, in ohms, of the wires that connect the secondary of the current transformer to the devices. **The Nomogram makes allowances for the return wire.** Add this resistance from Nomogram No. 2 to the impedance of the connected burdens.

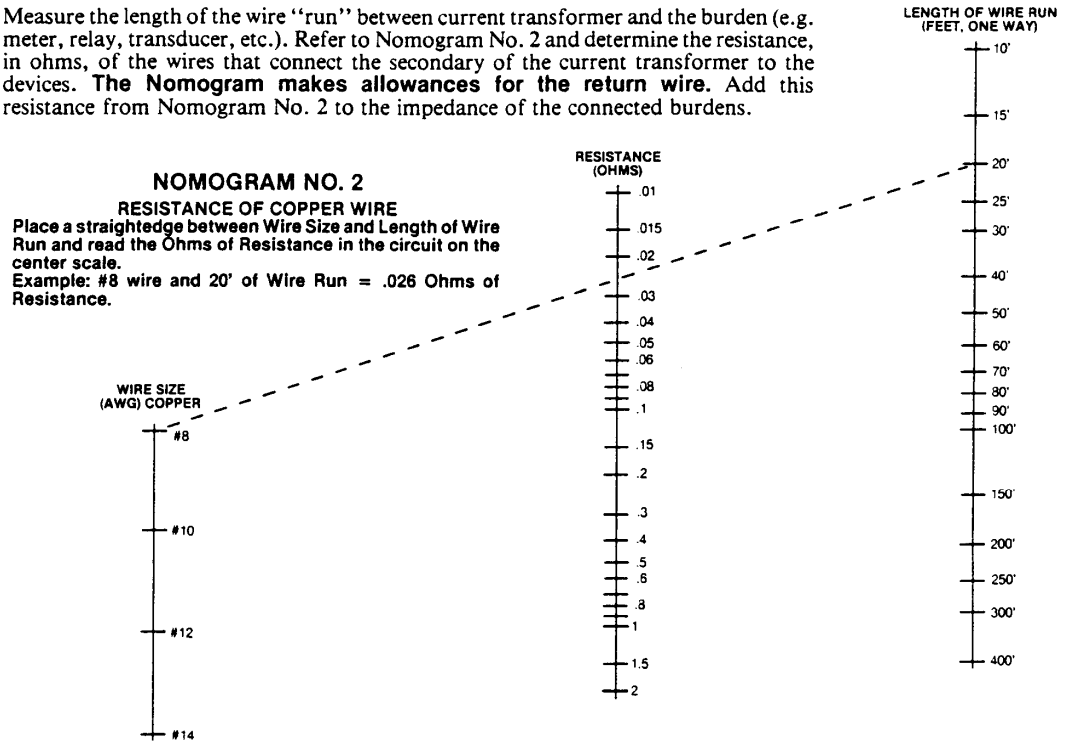

Fig.2

14

CHECK OUT PROCEDURE

The following procedures can be performed to verify proper operation of the transformer. You must refer to the electrical schematic supplied with the unit. If that is not available, refer to the nameplate on the unit, which shows the electrical ratings.

A. CHECK SHORT CIRCUIT CURRENT

1. Short each of the secondary high voltage terminals to ground.

2. Apply rated voltage to the primary and measure primary current.

3. The primary current should equal (+/-10%) that specified on the schematic or nameplate.

4. Tertiary voltage should be zero.

5. If the full primary voltage is not available, apply a lesser voltage and the primary current should be proportionately less.

B. CHECK OPEN CIRCUIT CURRENT

1. With secondary open circuit, apply rated primary voltage and measure primary current.

2. Current should equal 5-20% of the full primary current rating.

3. Tertiary voltage should be equal to its rating.

C. TAP SELECTION

1. This switch allows the user to choose from a total of (5) output voltages. **This switch is to only be operated in the DE-ENERGIZED state of the power supply.** The unit is not designed to allow for tap selection while the unit is running. If the tap selector is operated while the unit is running, arcing

will occur inside the tank and may cause damage to the unit. To change the output voltage, operate the switch as follows:

a) Turn off all power to the supply.
b) Open the cover door to the tap switch handle.
c) Loosen the 1/4" locking screw on the handle of the switch.
d) Twist the handle of the switch to the desired tap position. Make sure the switch mechanism seats properly into position.
e) Tighten the locking screw so that the tap switch cannot be moved.
f) Reenergize the unit.

*****Always make sure that both output tap switches are set to the same output voltage to ensure the best chance for balanced primary currents.**

15

STARTING THE POWER SUPPLY

After installation but before energizing the Power Supply for the first time:

1. *Check connections.* Although the equipment and devices have been completely tested at the factory, a final field check should be made.

2. *Double-check the following:*

Make sure that all blocks or other temporary braces used for shipment have been removed.

Make sure that no wires are pinched and that all enclosure parts are properly aligned and tightened when the covers are installed.

Make sure you have a supply of spare parts, fuses etc. on hand before start up (a recommended spare parts list is included with this manual).

Check field wiring for clearance to live busses and physical security to withstand effects of fault current.

Check all grounding connections.

Record any changes made to circuit diagrams during installation.

3. *Power up:*

Primary power may be applied to the L1, L2, & L3bushings at this time.

16

ROUTINE MAINTENANCE PROCEDURES

*****All maintenance work must be performed with POWER OFF. *****

Periodic maintenance should be performed at least once each six months, more often when used in a contaminating atmosphere and or under unusual loading conditions.

OUTSIDE CLEANING:

Remove accumulation of dust and other foreign matter from bushings, gauges and tank. Accumulation of matter on bushings can cause arcing to ground. Dirt on the tank can decrease the heat dissipation of the tank and cause the unit to overheat. Common household spray cleansers can be used on any grease stains or heavy dirt without harm to the finish.

INSPECTION OF OIL LEVEL:

Remember, level is indicated at 25C. Make adjustments for the actual ambient temperature. If it is necessary to refill the unit, use only the type of oil specified by NWL. Fill through the filling hole on the cover. Do not allow the unit to stand without liquid. After filling, allow the unit to stand for at least eight (8) hours to allow any entrapped air to escape from the transformer windings. Then excite the transformer at less than 50% of rated voltage for at least one (1) hour before placing in regular service at full voltage.

INSPECTION OF OIL LEVEL GAUGE:

It is recommended the oil level gauge be inspected on a yearly basis to ensure proper indication of the oil level. The gauge construction includes a float which floats in oil and turns a drive magnet as the oil level is lowered or raised. The drive magnet inside the tank is magnetically

coupled with a follower magnet connected to the gauge pointer. This magnetic gauge design permits the complete sealing of the oil inside the tank from the dial assembly outside. In the unlikely event the gauge should stop functioning properly, it must be replaced. To manually check the oil level, first remove excess pressure from the tank. Make sure the tank has had time to cool down to less than 40C before opening the pressure relief valve on top of the tank. Then, unscrew the NPT fitting from the lid and remove the valve assembly. The opening in the tank lid can be used to access the oil level with a dip stick. Use a non-conductive rod to dip the oil and compare the actual level with the level shown on the gauge. If the gauge does not reflect the actual level, the gauge must be replaced.

INSPECTION OF DEPOSITS INSIDE THE TANK:

The amount of deposit that accumulates in the oil is of great importance, particularly in open-type transformers. If a sample of oil from the bottom of the tank indicates that the oil is badly discolored or contains sediment, an internal inspection should be made for sludge deposits. Should there be deposits on any internal surface of the tank, filter the oil, and thoroughly clean the core and coil structure and tank by forcing clean, dry oil through the ducts and against all surfaces. Suitable pressure for this operation can be obtained from a filter press pump.

Moderately contaminated oil can be filtered and returned to the tank successfully. However, when oil is found to be in very bad condition, filtering may not sufficiently remove all of the sludge whereas soon after new deposits of sludge may be formed. When such conditions occur, it is recommended to obtain new oil. If it is necessary to purge the oil from the unit, contact NWL.

SAMPLING AND TESTING:

Oil should be sampled and tested through a Dissolved Gas Analysis every six months or so to determine the power supply condition. The recommended time between inspections and tests depends on the initial test results, the

local climatic conditions, the load on the unit and the maximum allowance of service interruptions. Intervals between tests should be one year or less depending on the above parameters, so that if any water is present in the unit, it may be readily taken care of.

SAMPLING PROCEDURE:

****DO NOT TAKE SAMPLES WHEN THE POWER SUPPLY IS ENERGIZED****

Contact NWL's service Dept. to obtain a oil testing kit. The NWL Sampling Kit will include a 40CC syringe type sample bottle and handling / shipping instructions. The following are a few important points which, through experience, have indicated as essential:

-Take samples when the oil is at least as warm as the surrounding air. Insulating oil is not hygroscopic, but cold oil may condense enough moisture from a humid atmosphere to seriously affect its insulating properties.

-Take samples from outdoor units on a clear day only, and guard against contamination by wind-blown dust, etc. The accuracy of results may be seriously affected if the samples are not correctly obtained, handled, and tested.

-Take the sample from the gate valve provided for that purpose.

Before taking a sample from the gate valve, carefully clean the opening and allow a pint of oil to run out so that any contamination that may have collected in the valve will be removed. For power supplies that are not equipped with gate valves, oil samples must be taken from the top access panel.

17

WARRANTEE STATEMENT

WARRANTIES & GUARANTEES

NWL agrees to correct any defect in material and workmanship of any equipment furnished by it to purchaser which may develop under normal and proper use (corrosions excepted) within the quoted warranty period of said equipment by repairing the defective part or parts or by replacing the same f.o.b. place of manufacture; provided, however, that any equipment not of NWL's design or manufacture is sold only under regular guarantee and responsibility of the maker and is guaranteed by NWL only to such extent.

NWL Guarantee is conditioned upon the following:

a. That purchaser provide the Normal Operating conditions for said equipment. If applicable, control setting data as outlined in operator's manual must be submitted to NWL within two (2) weeks after first energization.

b. This warranty is predicated on the basis that any storage will be sheltered from the elements in a cool and dry location, handling being such that equipment is in first-class condition prior to start-up, and will be used within its specified design limits. Failure to meet these requirements will void warranty in its entirety.

NWL will not be liable for any charges incurred by Purchaser or for its account in correcting defects or making changes in the equipment to conform to this agreement, unless NWL is given reasonable time to inspect and correct such defects or make the necessary changes. Any repairs or changes not authorized by NWL in writing voids the warranty.

NWL will not be liable for any consequential or special damages, loss or expense arising in connection with the use of, or inability to use, its equipment for any purpose whatsoever. NWL's liability, under no circumstances, will exceed the contract price for the goods returned as defective or unsuitable.

THE FOREGOING ARE NWL'S SOLE WARRANTIES AND GUARANTEES WITH RESPECT TO THE EQUIPMENT TO BE FURNISHED UNDER THIS PROPOSAL. NWL MAKES NO OTHER WARRANTIES OR GUARANTEES OF ANY KIND WHATEVER, EXPRESSED OR IMPLIED: AND IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE (WHICH EXCEED THE ABOVE OBLIGATIONS AND SPECIFICATIONS AS QUOTED) ARE HEREBY DISCLAIMED BY NWL AND EXCLUDED

18

UNIT SPECIFICATION SHEET

150KVA UNIT

ELECTRICAL SPECIFICATIONS:

KVA Rating ----------	150KVA max
KW output rating ----------	150KW max
Rated input voltage ----------	400 VAC, 3PH, 50Hz.
Rated input current ----------	216.5 Amps Max.
Short circuit Impedance ----------	100%
Output Voltage ----------	5 taps, see manual
Output Current ----------	5 taps, see manual
Inrush Current ----------	1X max.
Maximum Relative Humidity ----------	95%
Maximum permissible altitude ----------	10,000 ft
Minimum operating temperature ----------	-40° C
Maximum operating temperature ----------	+55° C
Maximum Oil temperature rise ----------	40° C
Maximum Thermal switch rating ----------	6 Amps @ 120volts AC
Resistive	5 Amps @ 120volts AC
Inductive	

PHYSICAL SPECIFICATIONS:

Weight ----------	8200 lbs
Oil type ----------	Cross Grade 206 Mineral Oil
Volume of oil ----------	285 gal.
Maximum outside dimensions ----------	70.2"W x 50"D x 66.7"H
Maximum floor loading ----------	500 pound per sq/ft
Pressure relief valve ----------	set @ 2psi
Junction Box ----------	Nema 4 (rated IP66)
Color ----------	Megatran 50 Grey
Input termination ----------	5/8"-11 copper stud on two LV input bushings
Output termination ----------	see main manual
Safety Ground termination ----------	1/2"-13 S.S. ground pad at foot of tank
Min. Ground wire size ----------	#3AWG Cu. per NEC, section 250
Recommended CB Size ----------	250A, 10x on inst. trip, 25KA interrupting min.
Recognized Certifications ----------	CSA Field Label to E60079-0, E60079-6 and E60079-7 Haz Loc Standards