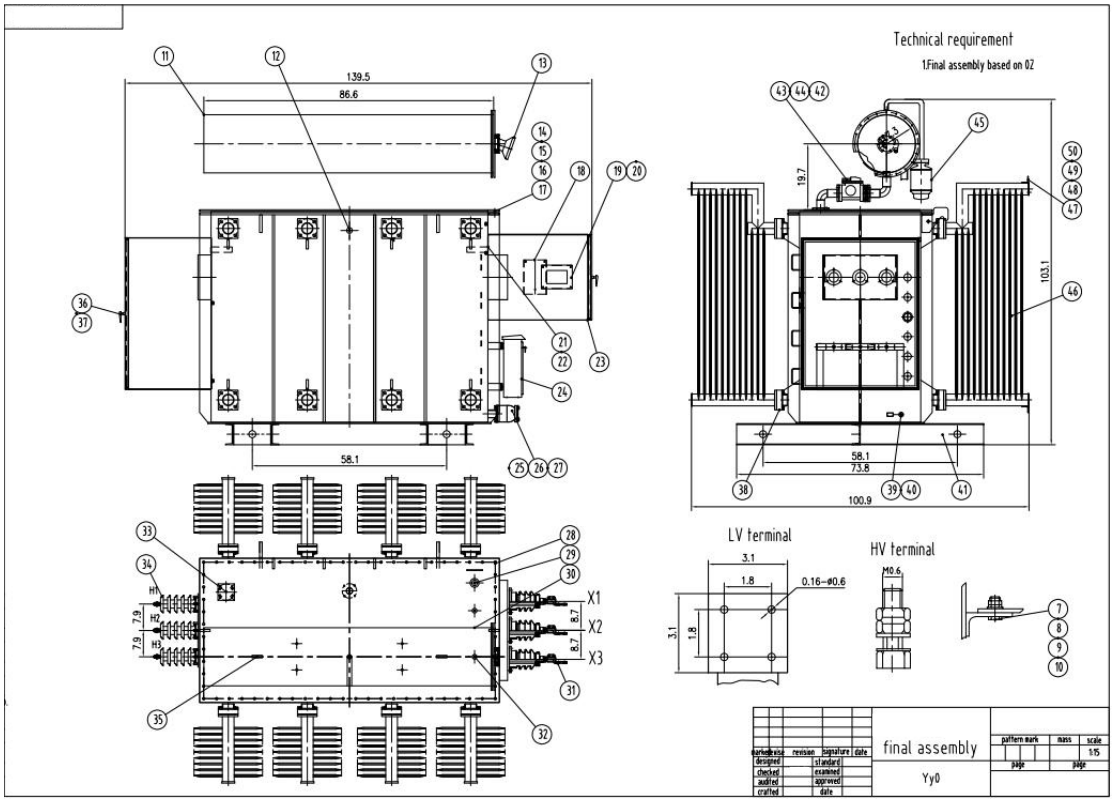
Transformer Assembly Instructions

MT-PSTC SERIES

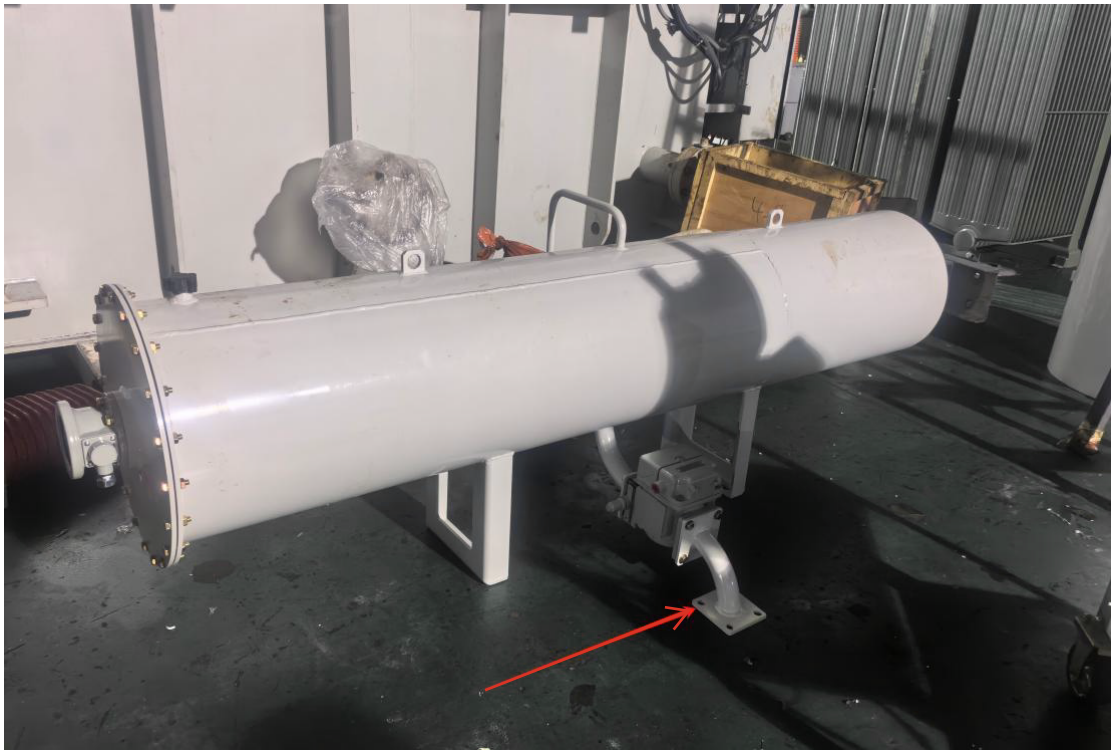


Main body: 1 unit

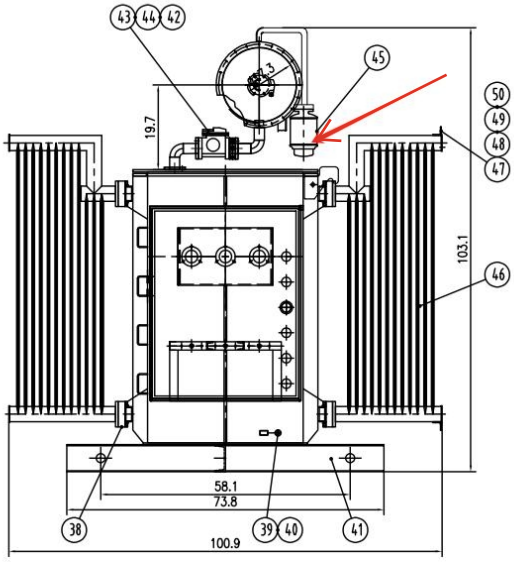


Conservator installation:

1. Connect conservator to the tank using appropriate nuts and bolts.



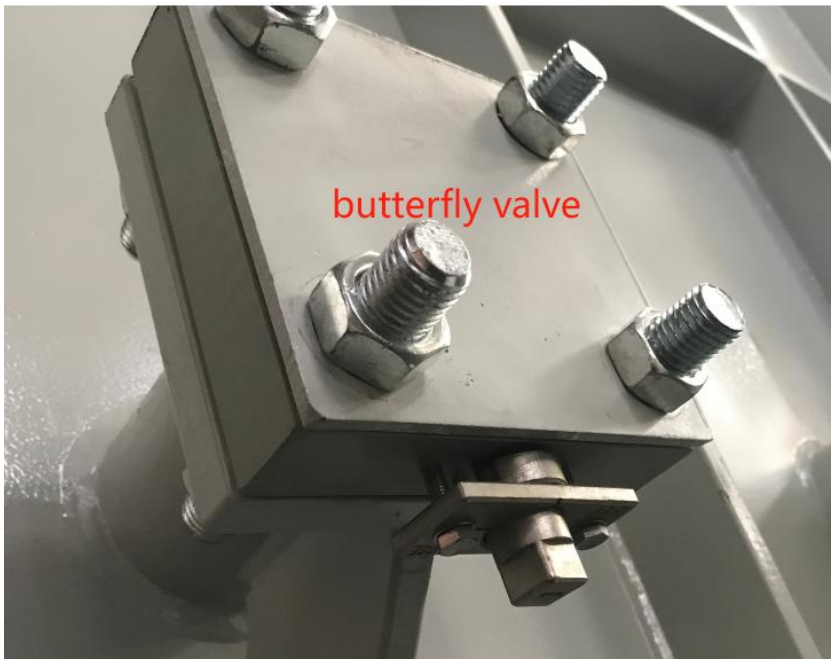
2. Add #45 moisture absorber to conservator:

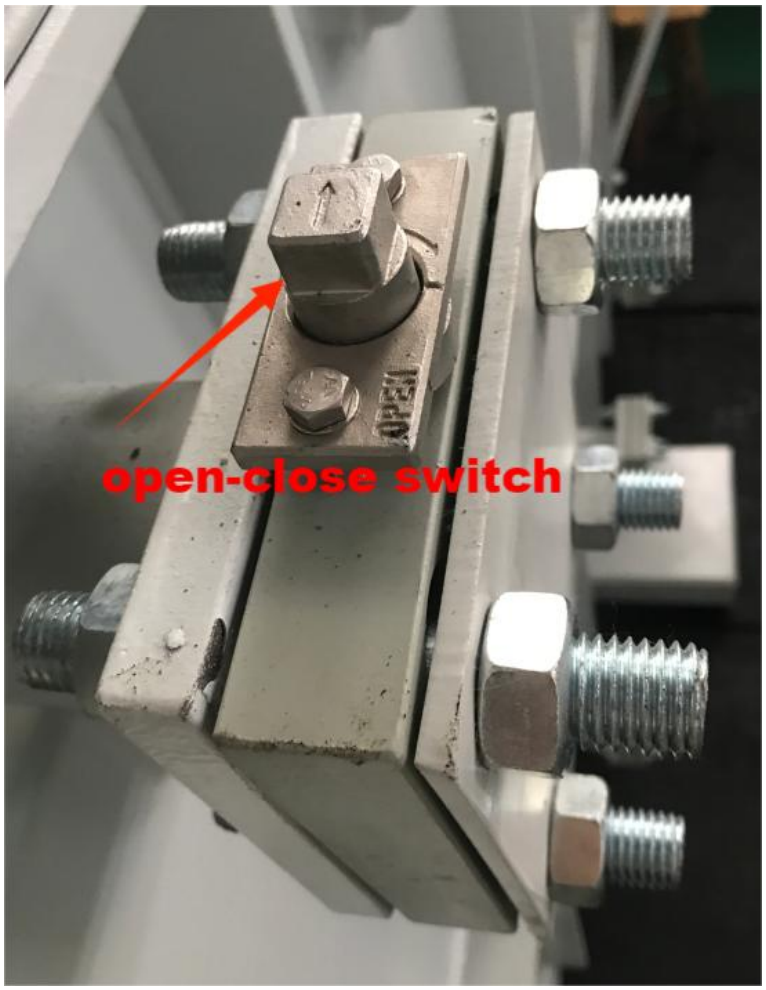




Radiator installation: total of 8 radiator panels should be installed.

1. Keep all the butterfly valves closed





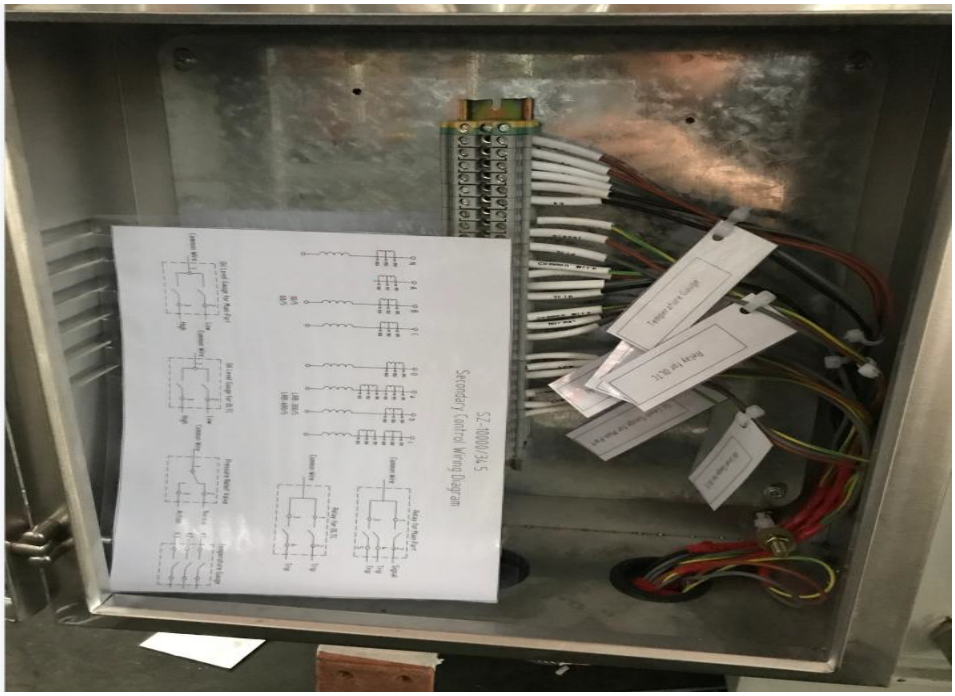
2. Connect the radiator mount points X-1&X-2 to 1-1&1-2, 2-1&2-2 and so on to connect them to the main unit, as labeled in below figures:





3. Open the butterfly valves after radiators are firmly connected.

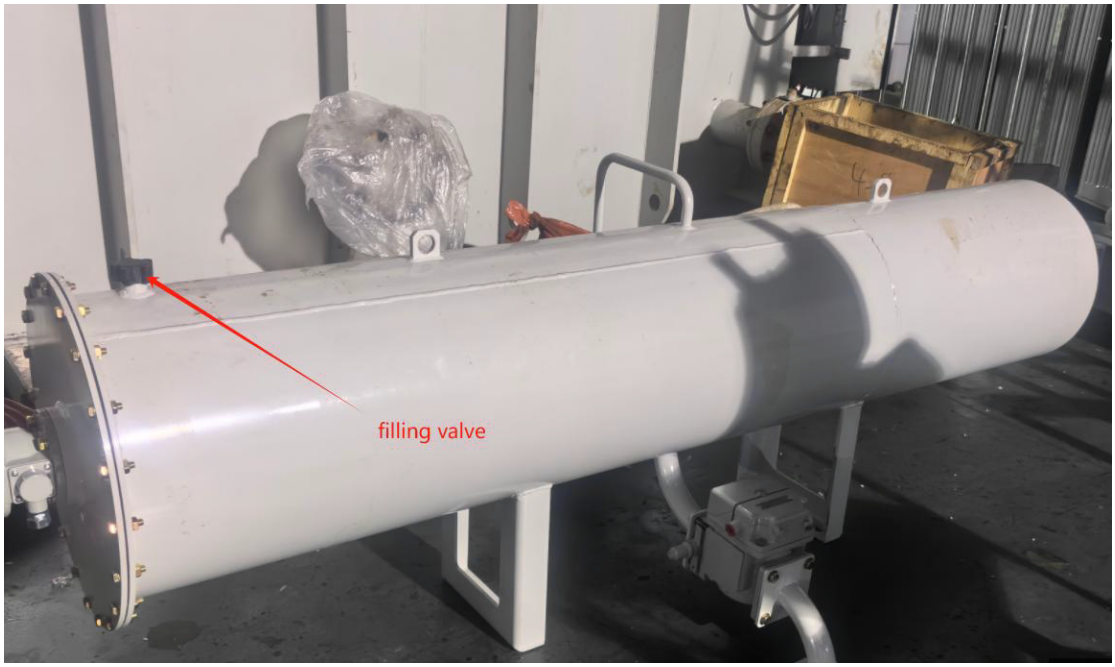
Wiring connection: connect the wires following the marks to terminal box according to the secondary control wiring diagram.



Supplemental Insulation Fluid:



Check and confirm the radiators and conservator are firmly connected, then add the supplemental insulation liquid from top of the conservator to whole transformer.



Assembled Unit:



220kV-330kV Oil-Immersed Transformer Installation and Operating Instructions

General Introduction

This manual provides instructions for the installation and operation of 220kV to 330kV oil-immersed power transformers. It covers key areas such as lifting, transportation, acceptance, storage, positioning, installation, pre-operation inspection, operation, and maintenance.

All personnel involved in the installation, maintenance, or repair of transformers must carefully review this manual to ensure the quality of installation and the safety of operators.

Note: When using this manual, refer to the appropriate sections in relation to the specific transformer model and structure during installation. If any questions arise, please contact the manufacturer for guidance and resolution.

Notes

Personnel involved in the installation and maintenance of transformers must have the appropriate professional qualifications, undergo specialized training, and carry out operations and equipment commissioning in compliance with the requirements outlined in this manual.

Adequate safety measures must be implemented throughout transformer operations, including transportation, positioning, hoisting, internal inspection, elevated work, oil treatment, and other processes, to ensure the safety of both personnel and equipment.

When performing any lifting operations, thoroughly assess the equipment's weight, height, working radius, strength, and other characteristics to select the appropriate lifting equipment, tools, and methods.

Ensure all necessary tools, equipment, components, and auxiliary materials are prepared in advance for the transformer installation to facilitate a smooth process. If there are any concerns about installation quality, consult the manufacturer for clarification.

When conducting outdoor operations that could compromise the sealing integrity—such as internal inspections, installations, or replacing pipeline components—pay close attention to weather conditions. Avoid working in environments with humidity levels exceeding 75%. If work must be done in such conditions, implement appropriate protective measures.

To ensure the quality of on-site transformer installation, strictly monitor the operation time and process quality. Prevent moisture absorption by the insulation and protect the tank from dust or foreign objects entering.

The product's operating conditions and key parameters are clearly indicated on the product nameplate.

Lifting and Transportation

Lifting the Transformer:

Lifting procedures for the main transformer body are outlined in the detailed drawing and transportation diagram. The carrier must fully understand the weight of the main transformer body and select the appropriate lifting ropes or slings. The angle between the lifting rope and the vertical should not exceed 30°.

When lifting the main transformer body, all lifting lugs or lifting eyes (typically four, marked with a prominent color) must be used simultaneously. All lifting ropes should be of equal length and evenly distribute the load. The ropes must be securely attached and kept close to the transformer body to prevent unhooking or damage to the lugs/eyes due to unbalanced forces. The main body should be lifted steadily without tilting.

Lifting Oil Tanks, Accessories, and Accessory Boxes:

Lifting operations for transformer oil tanks, accessories, and accessory boxes must be carried out according to the lifting markings. Ensure stability during the lifting process and avoid tilting. Special care must be taken with oil tanks, which must be lifted strictly in accordance with the designated markings.

Transporting the Transformer:

For oil-filled transport, the main body of the transformer maintains an oil level approximately 100mm below the tank top. The tank top is pressurized with dry gas at a pressure of 0.02MPa to 0.03MPa, with a dew point of ≤ -40°C, and is equipped with a pressure gauge.

For gas-filled transport, only residual oil remains at the bottom of the tank. The tank is filled with dry gas at 0.02MPa to 0.03MPa. The gas-filled transformer must maintain positive pressure during transport. If the pressure drops, it should be promptly replenished to 0.02MPa to 0.03MPa.

External large components requiring separate packaging and transportation prior to shipment include high-voltage bushings, medium-voltage bushings, low-voltage bushings, neutral point bushings, cooling devices (radiators or coolers) along with their brackets and connecting pipes, oil pipes connected to the main body, air guide pipes, thermometers, pressure-relief valves, conservators and their supports, ascending flanged bases, etc. (as specified in the dismantling list and product technical agreement). Please note that some packaging cases are not stackable.

Install three-dimensional shock recorders on the transformer main body during transport. These recorders must remain active throughout the entire process, from the start of transport to final positioning, to monitor any vibrations and impacts experienced by the transformer.

All hoisting points on the main body of the transformer must be used as fixed points and securely attached to the vehicle plate. The horizontal and vertical acceleration during loading, unloading, transportation, dragging, and on-site presence must not exceed 3 g (30 m/s²).

When switching transport modes or changing between multiple modes, promptly inspect the equipment's appearance and pressure status. Any abnormalities should be reported immediately to our company.

Therefore, please note the following:

Select an appropriate driving speed based on road conditions and maintain a steady speed whenever possible, avoiding sudden braking. To prevent overturning, the tilt angle of the transported unit must not exceed 15°. Avoid driving through road collapses, damage, or other similar hazards.

Whenever possible, tow the main body on level road surfaces to minimize impact. During transportation and positioning, promptly document and photograph any displacement of the main body or external damage. Report these findings to the transport provider and manufacturer to ensure corrective actions are taken.

Inspection and Storage of Transformer Main Body and Accessories

Inspection of Main Body:

Upon arrival of the transformer, the owner, the construction unit, and the supervisor should conduct a timely inspection in collaboration with our company or an authorized representative. If any abnormalities are found, please document and photograph the findings before reporting them to the carrier and our company to facilitate corrective actions. The inspection items are as follows:

Verify the position of the main unit on the transport vehicle against the shock recorder data (shock recorders are installed on the product box lids). If the main body shows significant displacement on the transport vehicle, or if shock records exceed specified limits in any direction (longitudinal, vertical, or lateral), take photographs and immediately notify our company to coordinate with the transportation department. If necessary, conduct an internal product inspection with relevant departments to determine if any damage has occurred.

Ensure all flange sealing plates, butterfly valves, and other components are securely fastened with no looseness.

Inspect for any damage, deformation, paint stripping, or oil leakage on the exterior of the main body.

Test the insulation resistance between the core and clamping components to ground using a 2500V megger; the resistance value must be ≥500MΩ.

For transformers transported fully pressurized with gas, the gas pressure gauge should show positive pressure within the range of 0.02MPa to 0.03MPa. For oil-filled transformers transported with oil, perform transformer oil testing.

Verify that the product nameplate and nameplate drawings conform to the contract specifications.

Ensure that all technical documents and installation drawings listed in the transformer factory file are complete.

Accessory Inspection:

After verifying that the model numbers of the delivered products match the contract, unpack and count the components and accessories according to the disassembly list and packing list. Confirm that the quantities and specifications are correct. If any discrepancies are found, document them in detail, have them signed and confirmed by both the supplier and the buyer, and immediately contact our company for further handling.

Inspect the accessory boxes according to the product disassembly list and packing list, checking the following items:
-Verify that the quantity of packaging boxes is correct.
-Inspect the exterior of the packaging boxes for integrity, checking for water damage, breakage, or deformation.
-Open the boxes to inspect the inner packaging (if present) for integrity, checking for water damage or contamination.
-After opening the inner packaging, inspect the accessories for damage, deformation, paint stripping, bumps, scratches, and rust.
-Exercise extreme caution when opening the outer and inner packaging to avoid damaging the internal accessories.
-Ensure all flange seals on accessories are intact, and the sealing covers are secure with no looseness.
-Verify that the oil level indicator on the corrugated oil conservator meets the shipping status requirements.

Transformer Oil:

Inspect the transformer oil container to ensure that its seal is intact and there is no oil leakage. The test results of oil samples (including the main body's oil, residual oil from inflatable transport, and added oil) must meet the requirements specified in Table 1.

If any abnormalities are detected, document them with photographs and report them to the transporter and manufacturer for corrective action.

Ensure that the transformer oil container is properly sealed with no oil leakage.

Table 1:Transformer Oil Quality Specifications

Voltage Level(kV)	Breakdown Voltage (kV/2.5mm)	Dielectric Loss 90℃（%）	Moisture μL/L
220	⩾45	≤0.5	≤15
330	⩾55	≤0.5	≤10

Body Storage:

After the transformers and accessories pass inspection, oil filling and installation should be completed as soon as possible to bring the transformer into its operational state. This ensures full protection of internal components, allows the transformer oil to freely contract and expand with temperature changes, and facilitates the inspection of the transformer's seal integrity.

If on-site installation conditions are unavailable, the main transformer body should be stored on elevated ground. The foundation for storage must be raised at least 200mm above ground level, with no accumulated debris, residual soil, or standing water near the foundation perimeter. The distance between the main body and construction work areas should exceed 10m.

The main body can be stored using one of the following methods:

Gas-filled storage: Fill the main body with dry gas at a positive pressure of 0.02MPa to 0.03MPa (dew point ≤ -40°C). However, this storage method should not exceed 3 months in principle.

Oil-filled storage: Install the oil conservator according to the manual, including the conservator of the OLTC and conservator breather. Fill the conservator with qualified transformer oil to the corresponding temperature mark, then open the relevant valves to allow the transformer oil within the main body to freely contract and expand through the conservator.

If on-site conditions prevent oil conservator installation, perform oil filling on the main body only. Open the butterfly valve on the upper part of the tank cover. Fill qualified transformer oil through the oil filling/draining valve at the tank bottom until it is approximately 100mm below the tank cover. Then, introduce dry gas into the tank from the top to achieve a positive pressure of 0.02MPa to 0.03MPa. This storage method should not exceed 6 months in principle.

Inspection During Main Body Storage:

Inflated Storage: Check the pressure daily for the first three days. If the pressure remains stable, it indicates a good seal. Otherwise, locate and repair the leak, then reinflate and recheck. After three days, inspect the pressure weekly and maintain records. If the pressure drops below 0.01 MPa, top it up to the required pressure. If the pressure exceeds 0.035 MPa, release air to bring it down to the required pressure.

Oil-filled Storage: During the first three days, conduct a daily visual inspection of the transformer, checking for oil leakage, ensuring the oil level is normal, and looking for external signs of rust. During these inspections, also check if the desiccant in the conservator breather has changed color or become ineffective. Each month, take an oil sample from the transformer tank to perform dielectric strength tests and measure micro-water content. Any abnormalities detected must be reported and addressed promptly.

After sudden temperature changes, hoisting, relocation, or transportation, inspect for loose fasteners, oil leaks, or sudden drops in pressurization.

Accessory Storage:

Parts, components, and assemblies that have undergone unpacking inspection should be stored according to their performance characteristics. For items transported in sealed packaging, the integrity of the seals must be inspected to ensure reliable sealing. Measures should be taken to prevent direct exposure to rain, snow, or corrosive gases. Surface rust should also be prevented.

Disassembled components such as conservators, air coolers, radiators, and ascending flanged bases that were shipped sealed may be stored outdoors. However, their seals must be inspected before storage to ensure reliability. During storage, prevent surface rust and contamination.

All assembly components are packaged in wooden crates marked with spray-painted labels indicating rainproofing, moisture resistance, handling with care, and orientation. Therefore, they must be stored indoors in a dry, well-ventilated area. If indoor storage is unavailable on-site, outdoor storage is permitted for no longer than 3 months.

When storing accessories and packaging boxes outdoors, ensure the following:

-Position accessories and packaging boxes on elevated ground to prevent water accumulation or flooding beneath them.

-Cover accessories and packaging boxes completely with waterproof tarps. Remove the tarps after each rainfall to allow the boxes to air-dry and prevent moisture buildup.

-Conduct routine inspections of the condition of accessories and packaging boxes, particularly those containing instruments, meters, or electrical components (e.g., operating boxes, master control boxes). Address any abnormalities promptly.

Transformer Oil Storage:

Environmental Requirements: The environment for storing transformer oil should be well-ventilated, dry, and cool. Avoid exposure to direct sunlight and rain. Keep the oil away from heat sources and open flames to prevent combustion or explosion due to overheating.

Storage containers for transformer oil should be dedicated oil tanks or specialized drums. Drum-packed transformer oil must be stored indoors in a dry, well-ventilated area.

Container Integrity: Storage containers must have excellent sealing properties to prevent contamination of transformer oil by air, moisture, or impurities. Valves and interfaces on storage containers should be regularly inspected and maintained to ensure proper sealing. If the container is exposed to the atmosphere, it must be equipped with a desiccant breather.

Regular Inspection and Maintenance: Conduct oil sample testing on stored transformer oil every three months. Perform necessary maintenance and treatment based on test results. Additionally, regularly inspect both the external and internal conditions of storage containers to ensure there is no damage or leakage.

Main Body Installation

Verify the foundation accuracy against the foundation diagram in the transformer outline drawing. The overall foundation flatness tolerance should be ±2mm.

The transformer's pulling surface must be solid and level. Pulling points should be attached to the transformer's dedicated reinforcement plates.

After transporting the transformer to the designated location, use jacks to lift it. Lay steel rails or rollers, then use a pusher or puller to position the transformer onto the foundation at a movement speed of approximately 5m/min.

Lift the transformer off the foundation using jacks, remove the towing equipment, and then slowly lower the transformer onto the foundation. When lifting the main body, use all jacks on one side of the transformer and ensure synchronized lifting to prevent tilting or overturning.

The positioning deviation of the transformer should not exceed 5mm. Refer to the transformer outline drawing for the main body positioning, foundation location, and jack positions.

After positioning the main body, securely weld the fixing clamp (for main transformers) or base plate to the foundation embedded iron.

Installation Inspection of Main Body:

Note: Internal inspections, cover removal, and installation must not be performed during rainy, snowy, or windy weather (wind force of 4 or above) or when the relative humidity exceeds 75%. Opened covers and other areas must be cleaned and dusted beforehand to strictly prevent dust, foreign objects, or other contaminants from entering the main body.

To maintain optimal insulation performance and prevent moisture ingress, priority should generally be given to avoiding cover removal inspections. Whenever possible, conduct internal tank inspections through manholes, supplemented by visual checks via the main pipeline and riser flange openings. This minimizes the exposure time of the main body.

Internal Inspection of Transformer:

Transformer Evacuation (Deaeration)

Connect the butterfly valve at the top of the oil tank to the vacuum unit. Refer to the outline drawing for the butterfly valve at the top of the main transformer. Open the butterfly valve and activate the vacuum unit to evacuate the system to below 1000 Pa.

Connect the oil drain valve at the bottom of the tank to a dry air generator (dry air dew point: ≤ -40°C). Slowly open the valve to relieve the vacuum in the main body.

Internal Inspection Precautions:

-Personnel must not enter the tank until the main body has been evacuated and dry air has been introduced to prevent suffocation hazards.

-Continue blowing dry air throughout the inspection until the cover is closed, maintaining a flow rate of approximately 200 L/min.

-Inspectors must wear clean clothing, shoes, and socks. No personal items, other than tools, are permitted inside the tank.

-Implement a strict tool registration and inventory system to prevent tools from being left inside the tank.

-Only flashlights or explosion-proof lamps may be used inside the tank. Disassembling tools inside the tank is strictly prohibited.

Minimize the duration of the core's exposure to air. The maximum allowable exposure time (from opening the cover plate to releasing the transformer seal until re-evacuation) must be controlled under the following conditions:

-Relative air humidity ≤ 65%, exposure time: 14 hours

-Relative air humidity > 65% – 75%, exposure time: 10 hours

-If the core temperature exceeds the ambient air temperature, the exposure time may be extended by 2 hours.

-During internal inspection, take care not to damage core components (insulators, leads, switches, etc.).

-After completing the internal inspection, promptly reseal the corresponding covers.

Internal Inspection Items:

-Inspect visible connection points for loose fasteners.

-Check the shielding and core insulation for any displacement and ensure that the strapping is secure.

-Verify the insulation integrity of visible leads; check that supports and clamps are firm, and confirm secure connections between leads and switches. Reset, secure, and re-wrap any leads that show signs of displacement, tilt, or looseness.

-Inspect visible pressure pins, locating pins, and fasteners for any loosening or displacement.

-Verify the insulation integrity between the core and clamping components using a 2500V megohmmeter, ensuring there are no multiple grounding points.

-Inspect the cleanliness of the box bottom and remove any foreign objects or contaminants.

Core Inspection:

A core inspection shall be performed if any of the following abnormal conditions occur:

-Severe impact occurred during transportation or loading/unloading of the main body.

-During internal inspection, any of the following abnormalities are found: tilted switches or lead brackets, severely loose or missing fasteners, significant lead displacement, loose insulation, multiple grounding points on the core or other components, or missing parts inside the tank.

-The user deems a cover removal inspection necessary.

Core inspections must be conducted under the guidance of the transformer manufacturer's specialists, observing the following precautions:

-For transformers transported with dry air, all residual dry gas must be completely purged before inspecting the core.

-When lifting the upper oil tank section of a no-load tap-changer transformer, first remove the operating lever of the off-circuit tap-changer switch and record the phase sequence for reinstallation. For on-load tap-changer transformers, remove the upper flange of the bell-type switch and the relevant core components according to the switch manual. Refer to the on-load tap-changer switch manual for further details.

-Lifting the upper oil tank must be performed using balanced lifting.

-Equipment inspection tools must be thoroughly cleaned and registered by designated personnel.

-The ambient air temperature should not fall below 0°C, and the equipment temperature should not be lower than the ambient air temperature. If the equipment temperature is below ambient air temperature, the equipment must be heated to at least 10°C above the ambient air temperature.

-The exposure time of the core to air shall be timed from the start of oil drainage or dry gas purging, as follows:

-When relative humidity ≤ 65%, exposure time must not exceed 8 hours.

-When relative humidity ≤ 75%, exposure time must not exceed 7 hours.

-If the core temperature is higher than the ambient air temperature, the exposure time may be extended by 2 hours.

-Ladders and sharp objects used for core inspection must not rest on leads, conductor clamps, or insulating components. Climbing on conductor supports or leads is prohibited.

-Coil leads must not be arbitrarily bent and must retain their original installation positions.

-**Inspection Items for Core Hoisting Cover:**

-Inspect the core for any displacement or deformation.

-Inspect the coil for displacement, looseness, insulation damage, foreign objects between layers, and check if axial clamping pins or blocks are loose.

-Inspect the leads for damage, deformation, loose or damaged insulation wrapping, proper lead positioning, integrity of the lead root and tapered insulation, and correct insulation clearance.

-Remove leads using temporary supports or reinforcement devices.

-Verify that all grounding components are properly grounded.

-Ensure all fasteners are securely tightened.

-Check that the contact positions of all three phases of the tap-changer are consistent and aligned with the factory-set position.

-Inspect the interior tank walls and shielding devices for burrs, sharp edges, foreign objects, or contaminants.

Component Installation

Before installation, thoroughly clean the connection ports and surrounding areas of the transformer body and accessories to prevent internal contamination.

Installation Procedure:

Accessories and instruments, such as bushings, coolers, radiators, instrument transformers, oil conservators, thermometers, oil level gauges, gas relays, pressure relief valves, pressure relays, etc., along with corresponding electrical control circuit connections, must be inspected and installed according to their respective manuals, the transformer outline drawing, and wiring diagrams.

Unless otherwise specified, the installation procedure should follow the guidelines in **Table 2**, on the next page.

Before installation, inspect all connection surfaces and sealing surfaces for cleanliness. Ensure that sealing surfaces and gaskets are smooth and undamaged. Replace any gaskets that show cracking, deformation, or other damage, and ensure gaskets are not installed at an angle.

Bolts and nuts at all connection points should not be fully tightened in a single pass; instead, tighten them in a circular pattern to ensure even compression of the gasket and uniform stress distribution across all flange interfaces.

Keep unused insulating components and open flange ports of the main body free from dust and foreign objects.

Install and inspect switches according to the switch and operating mechanism manuals. After completing switch installation and testing, adjust the switch to the rated tap position.

Table 2

No.	Process	Work Content
1	Tap Changer Operating Rod	1) For no-load tap changer, use the bushing mounting holes to verify that the operating lever is correctly positioned. Check that the three-phase indicator positions are aligned (operation permitted only after passing inspection). Install the positioning screws and rain cover. 2) Install the horizontal and vertical shafts according to the on-load tap-changer manual. Adjust the reverse rotation count and limit switch sensitivity. Connect the remote display unit.
2	Ascending Flanged Base (bushing current transformer)	Install components according to the assembly drawing's positional markings, direction, and phase sequence. Pre-wind the transformer coil leads to facilitate bushing installation.
3	Oil Guide Pipeline	Install piping per the assembly drawing and pipe markings without arbitrary changes. Install pipe valves simultaneously.
4	Conservator	Install the conservator, connecting pipes, diaphragm, dehydrating breather, and connecting pipes according to the oil conservator installation manual and assembly drawing.
5	Bushing	1) The bushing shall be hoisted and installed in strict accordance with its instruction manual. The leads at their root section must not be subjected to hard pulling, twisting, or sharp bending. The connection points of the leads (e.g., crimped joints, fastening points) must not extend into the interior of the bushing. 2) When the lead root is equipped with an insulating cone (stress cone), the cone must be fully seated inside the grading sphere (equalizing electrode).
6	Radiator	For oil-immersed natural cooling and forced-air cooling transformers using finned radiators, prevent radiator impact and deformation. Lift radiators at designated points to avoid mutual collision. Avoid rough handling to prevent radiator scratches that could cause oil leakage.
7	Tube Connector	Tube connectors for connection shall be reassembled according to the markings. Flange connections at joints shall exhibit uniform gaps and no deformation.
8	Instrumentation, Control, and Electrical Wiring	Verify that the initial settings for instruments and gauges are correct. Wiring and connections must follow the relevant control circuit diagrams in the factory documentation. The thermometer housing must be filled with insulating oil.

Oil Filling

Preparation:

Transformer Oil Inspection:

This step may be omitted if the oil sample passed inspection upon delivery and installation proceeds immediately. Otherwise, the oil sample must be retested. If the oil sample does not meet the requirements of Table 1 or the user's specifications, oil filtration must be performed until compliance is achieved.

Pipeline Connections:

Inspect and clean the pipelines and pipeline interfaces. Flush thoroughly with qualified transformer oil before use.

Connect the vacuum line fitting to the gas relay flange on the main connection pipe. Connect the on-load tap-changer oil chamber to the main body. Connect the oil filling line fitting to the oil filling/draining valve at the bottom of the lower tank section. Open all valves connecting assemblies and components (e.g., coolers, radiators) to the transformer main body.

Install the vacuum gauge as close as possible to the transformer main body.

Inspect all flange bolts for tightness and ensure that all flange surfaces are free of deformation or warping.

Open the oil filling pipeline valve.

Vacuum Oil Filling:

Vacuum application and oil filling must be performed on days without rain or fog, and when the ambient humidity is ≤ 75%. Before oil filling, verify that all exposed, groundable components and the transformer casing are properly grounded.

Start the vacuum unit. When the vacuum level reaches ≤ 133 Pa, stop the vacuum unit and calculate the leakage rate. The leakage rate of the tank and pipelines must be less than 800 Pa·L/s. If the leakage rate does not meet this requirement, locate and repair any leaks before resuming vacuum pumping. Maintain the vacuum for 8 hours.

After the required vacuum holding time is achieved, start the oil filter (oil filling unit) to fill the transformer with oil. The oil filling rate must not exceed 5,000 L/h, and the vacuum level must be maintained at ≤ 133 Pa. Stop filling oil when the oil level reaches approximately 200 mm below the top cover, and simultaneously begin filling oil into the switch oil chamber. Continue maintaining the vacuum at ≤ 133 Pa for an additional 4 hours.

Oil Replenishment, Seal Test, and Standing Time:

Prior to oil replenishment, disconnect and remove all vacuum lines, and ensure that the flange of the switchgear oil chamber is securely sealed. Position an oil containment tray beneath the breather outlet of the conservator. Connect the oil filling pipeline to the conservator's filling valve and begin oil injection. Once oil begins to flow into the conservator, carefully regulate the filling speed. Continue filling until the oil level reaches the mark corresponding to the ambient temperature, as specified in the conservator's manual and indicated on the oil level gauge.

Upon completion of oil replenishment, open the vent plugs of the riser, oil guide pipe, cooler oil collection box (radiator), oil reservoir, and other relevant components to vent air. Immediately tighten the vent plugs once oil discharge ceases.

Perform a comprehensive seal test. Typically, apply 0.03 MPa of air pressure (using dry gas) at the oil reservoir vent port.

Note:

For bladder-type reservoirs, the bladder cavity is connected to the reservoir vent port.
For bellows-type reservoirs with external oil, keep the vent port closed.
For bellows-type reservoirs with internal oil, do not apply pressure; instead, disconnect the gas relay at the main connecting pipe and apply 0.05 MPa air pressure to the main body.

The leak test duration must be at least 24 hours. During this period, inspect the tank for oil leakage and monitor for any pressure drop.

Standing Time: Starting from the completion of the seal test, allow a minimum of 24 hours. During this period, perform multiple bleed operations on all bleed plugs. After settling, check the oil level in the reservoir. If it falls outside the ±5°C range, adjust the oil level accordingly.

Hot Oil Circulation:

To remove moisture from the insulation surfaces of the core during installation, hot oil circulation should be performed on the transformer.

During circulation, the inlet and outlet ports should be arranged diagonally, with the inlet at the top and the outlet at the bottom. Connect the inlet and outlet ports of the vacuum oil purifier to the butterfly valve at the top of the oil tank and the ball valve at its diagonal lower position, respectively, to perform hot oil circulation through the vacuum oil purifier.

Maintain the oil temperature at the filter outlet between 50°C and 60°C. The total oil circulation volume must be at least three times the transformer's oil capacity.

Upon completion of circulation, oil samples must meet the standards specified in Table 1. After completing hot oil circulation, the transformer enters the settling phase.

Transformer Cleaning and Touch-Up Painting:

Upon completion of all transformer installation tasks, remove all debris from the exterior and dismantle any temporary fixtures not required for transformer operation. Clean the transformer surface using a suitable detergent to remove oil, mud, or other stains accumulated during transportation and assembly. Touch up any damaged paintwork—reapplying paint to the entire surface if necessary—ensuring that the paint grade and color match the original specifications.

Inspections and Test before Operation:

Pre-Commissioning Inspection:

Verify the correct position of all butterfly (gate) valves.

Inspect all components to ensure they are in good condition, following each component's instruction manual. Check for oil leaks, and ensure that thermometer housings are properly filled with transformer oil.

Confirm reliable grounding of the core, clamping devices, and oil tank. Ensure that all temporary grounding wires are removed and that no redundant grounding points exist.

Verify that the tap changer is in the correct position.

Confirm that the oil level indicator (e.g., bushing on the oil conservator) is correctly positioned.

Ensure that settings for the gas relay, pressure relief valve, oil pump, fan, oil gauge, thermometer, current transformer protection, alarms, and control circuits are correct.

When commissioning the transformer at low temperatures (daily minimum below 5°C), ensure that the oil temperature at the top of the transformer reaches above 10°C and remains there for at least 24 hours. Verify that the moisture content of the oil meets the requirements of Table 1 and the agreement to prevent ice formation inside the transformer.

Verify external air insulation clearances. Confirm that the air insulation distances between bushings of different voltage levels, and between bushings and ground, comply with relevant standards.

Pre-Commissioning Tests:

On-site Acceptance Test Items and Procedures for Transformer Body:

-Transformer sealing test
-Transformer oil test
-Voltage ratio measurement and verification of connection group designation
-Winding resistance measurement
-Winding insulation resistance to ground, insulation absorption ratio, and polarization index measurement
-Insulation resistance measurement of the core and clamping components
-Bushings: Dielectric loss factor and capacitance measurement (including end shields and voltage taps)
-No-load loss measurement at no-load current
-Short-circuit impedance measurement at low voltage
-External withstand voltage test
-Long-duration induced voltage test with partial discharge measurement
-Gas chromatography analysis of dissolved gases in oil
-CT test for bushings
-Winding frequency response characteristic test
-Impulse closing test at rated voltage
-Sound level measurement

Operation and Maintenance

Monitoring During Transformer Operation:

Oil sample testing during the initial operation period shall comply with the following provisions:

First month of operation:Take oil samples for testing every 10 days;

Second to sixth months of operation:Take oil samples for testing once per month;

Thereafter:

Test once every three months;

It is recommended to perform gas-in-oil analysis to detect operational issues early.

Minimum permissible standards for oil quality during operation:

Voltage Level(kV)	Breakdown Voltage (kV/2.5mm)	Dielectric Loss 90℃（%）	Moisture μL/L
220	⩾40	≤4	≤25
330	⩾50	≤4	≤15

Special Patrol Inspections:

Special patrol inspections shall be conducted on transformers under the following circumstances, with increased inspection frequency:

-Within 72 hours after a transformer undergoes maintenance, modification, or is returned to service.
-When a transformer exhibits serious defects.
-During sudden weather changes (e.g., strong winds, heavy fog, heavy snow, hail, cold waves).
-During thunderstorm seasons, particularly after thunderstorms.
-During high-temperature seasons or peak load periods.
-When the transformer is operating under emergency load conditions.

Continuously monitor and record the transformer's voltage, current, top oil temperature, and the highest top oil temperature reached.

Continuously inspect the transformer's appearance and sound, oil level in the oil conservator, and the appearance and oil level of bushings, radiators, gas relay, pressure relief valve, thermometer, moisture absorber, and other relevant components.

Periodically test the chromatographic condition of transformer oil and monitor heating conditions in areas such as the transformer tank.

Other monitoring items, routine inspection items, and their cycles shall be conducted in accordance with the Power Transformer Operating Procedures, component manuals, relevant standards, and procedural requirements.

Oil Top-Up During Operation:

Qualified transformer oil may be added during operation through the filling/draining pipe at the bottom of the oil conservator. Refer to the oil conservator manual for specific procedures. Close the oil filling valve after completion.

Monitoring Core Grounding Conditions:

The core is externally grounded via a grounding bushing connected to the tank. The condition of the core insulation can be assessed using the core grounding terminal. When measuring, connect the meter before opening the grounding conductor to avoid high voltage during momentary open-circuit conditions. Ensure that reliable grounding is restored after the measurement.

Fault Analysis and Troubleshooting for Transformers:

If the gas relay alarms, promptly investigate the cause and collect gas samples for analysis.

If transformer oil quality deteriorates rapidly, immediately analyze the cause and implement corrective measures.

Immediately cease operation and inspect the transformer under the following conditions:

-Transformer oil temperature rise exceeds permissible limits.
-Significant oil leakage causes a rapid, uncontrollable drop in oil level.
-Abnormal, uneven internal noises or cracking sounds occur.
-Abnormal oil temperature rise under normal cooling and load conditions.
-When the pressure relief valve, oil conservator, or switch releases oil explosively.
-When bushings are severely damaged or exhibit discharge.
-When chromatographic analysis of oil samples indicates combustible gases or a rapid increase in total hydrocarbons.

Upon occurrence of any of the above situations, measure the excitation current to determine whether the coil or core has a partial short circuit or eddy currents, and conduct a physical inspection of the core.

Construction Equipment and Primary Materials List(Subject to Adjustment Based on Specific Installation Conditions)

No.	Name	Quantity	Requirements
1	Oil Storage Tank	1 set	Equipment provided as specified.
2	Vacuum Oil Purifier	1 unit	Pumping speed ≥ 1000 L/s, ultimate vacuum ≤ 5 Pa.
3	Pressure Oil Purifier	1 unit	8000 L/h, for temporary oil fill and oil drain.
4	Transformer Oil Testing Equipment	1 set	Testing for pressure resistance, moisture content, dielectric loss, gas analysis, etc.
5	Dry Air Generator	1 set	Dry air flow rate ≥ 500 L/min, dew point ≤ -40 °C.
6	Oil Injection Piping	As needed	Flange connections matched to valve dimensions specified in general assembly drawing.
7	Vacuum Hose	As needed	Flange connections matched to valve dimensions specified in general assembly drawing.
8	Site Lighting Equipment	1 set	Equipment for nighttime operations.
9	Dry and Wet Meter	1	Measures air humidity.
10	Megger	1	2500 V.
11	Vacuum Gauge (Meter)	2	
12	Fastening Bolts and Screws	2 sets	
13	Plastic Coat	3 sets	Brand new, no buttons; used for inspecting the body.
14	High-Top Oil-Resistant Boots	3 pairs	Worn by internal inspectors.
15	High-Intensity Flashlight	2	Voltage: 4.5–6 V; required for internal inspection.
16	Lifting Equipment (including lifting attachments)	1 set	Select based on actual conditions.
17	Manual Chain Hoist	2 pieces	Capacity: 5000 kg and 3000 kg.
18	Ladder	2	Lengths: 5 m and 2 m.
19	Nylon Rope and Shackles	2	≥ 8 mm, length 20 m.
20	Safety Harness	Several	For elevated work.
21	Dry Powder Fire Extinguisher	As needed	Fireproof.
22	Cotton Yarn	As needed	Keep dry.
23	Brush	2	For painting use.

Applicable Standards (U.S./International Equivalents)

Temperature rise of power transformers – IEEE C57.12.00 / ANSI C57.12.90
Insulation levels, dielectric tests, and external clearances – IEEE C57.12.90 / IEC 60076-3
Lightning impulse and switching impulse testing – IEEE C57.12.90 / IEC 60076-3
Short-circuit withstand capability – IEEE C57.12.00 / IEEE C57.12.91
Transformer oil quality and testing – ASTM D3487, ASTM D877, ASTM D1816
Operation and maintenance of power transformers – IEEE C57.91 (Guide for Loading), IEEE C57.106 (Installation Guide)
Grounding and secondary connections – IEEE Std 142 (Green Book), NEC Articles 250 / 450
Acceptance testing of electrical apparatus – NETA ATS / ANSI/NETA MTS

THESE INSTRUCTIONS MAY NOT COVER ALL DETAILS OR VARIATIONS OF THIS PRODUCT FOR YOUR EQUIPMENT OR INSTALLATION REQUIREMENTS. SHOULD FURTHER INFORMATION NOT COVERED BY THESE INSTRUCTIONS BE REQUIRED, PLEASE CONTACT LARSON ELECTRONICS BY EMAIL AT SALES@LARSONELECTRONICS.COM OR BY PHONE AT 1-877-348-9680 FOR FURTHER ASSISTANCE.

PLEASE VISIT LARSONELECTRONICS.COM FOR **WARRANTY** AND **RETURN** INFORMATION.