INSTRUCTIONS

GEK-24902

ADJUSTABLE SPEED DRIVES ENVIRONMENTAL FACTORS

RELATED TO:

STORAGE

INSTALLATION

OPERATION

MAINTENANCE

GENERAL ELECTRIC

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These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

EQUIPMENT ENVIRONMENT

STORAGE, OPERATING CONDITIONS & CLEANING INSTRUCTIONS

INTRODUCTION

Environmental conditions encountered in storage, installation, operation and maintenance affects the performance and operational life of a drive system. Proper performance and normal operational life can be expected by maintaining a proper environment for the drive system. Environments which include one or more of the following characteristics should be considered hostile to drive performance and life.

1. Dirt, dust and foreign matter
2. Vibration and shock
3. Moisture and vapors
4. Temperature extremes
5. Caustic fumes
6. Power line fluctuations
7. Electromagnetic interference (noise)

The more common types of environmental problems can be avoided by proper storage, installation and maintenance procedures. In addition, once a hostile environment is recognized, certain measures can be incorporated into the design of the equipment to lessen the likelihood of premature failure or reduced life.

The following will provide information and instructions to lessen or eliminate certain types of potential problems.

Storage Requirements

The equipment must be placed under adequate cover immediately upon receipt as most packing cases are *not* suitable for out-of-doors or unprotected storage.

If the equipment is not to be installed immediately, it should be stored in a clean, dry location at ambient temperatures of from −20°C (−4°F) to +55°C (131°F). The surrounding air must be free of chemical and electrically conductive contaminants. The equipment can normally be stored at 55°C for a period up to six months. If stored at 40°C or lower, the storage normally can be up to one year.

Precautions should be taken to prevent condensation from forming within the equipment enclosure. If the storage environment exceeds a 15°C (27°F) drop in temperature at 50% humidity over a 4 hour period, a space heater should be installed inside each enclosure to prevent condensation. Higher humidities with smaller temperature changes will also cause condensation.

Condensation occurs when air containing some moisture is cooled below its dew point. The dew point represents saturation of the air, and is the temperature at which the moisture starts to condense into water. It is not a fixed temperature but rather is related to the initial temperature of the air and its relative humidity at that temperature. The amount of moisture that can be held in the air is related to the air temperature. The following examples illustrate some of these relationships.

Air Temp		Relative Humidity	Wgt. of Moisture in 1 lb. of	Dew Point	
F	C	%	Dry Air, Grains	F	C
104	40	100	345	104	40
104	40	80	270	97	36
104	40	40	130	75	24
104	40	10	32	37	3
50	10	100	54	50	10
50	10	80	42	43	6
50	10	40	21	25	−4

In industrial drives, condensation is a possibility in applications where air temperature changes are large and rapid and/or the air is moist. For example, an outdoor crane operating in sunshine on a winter day, which then is shut down and parked in the shade will experience a rapid drop in temperature. This can result in condensation inside the drive. Adding heat to keep the air temperature above its dew point can prevent condensation.

If storage temperatures below −20°C (−4°F) are likely to be present, then auxiliary heat should be added in each enclosure to maintain temperature at or above −20°C. For assistance in heater size selection contact the General Electric Company.

When a drive that has been in operation is shut down for either a short or extended period of time, it is recommended the environmental conditions be maintained the same as when in operation. Power, ventilation, or heating and air conditioning (if used) should be left on during the downtime to prevent large changes in temperature and possible moisture condensation.

Installation

The drive system is designed for operation in ambient temperatures ranging from 10°C (50°F) to 40°C (104°F) and relative humidities up to 90 percent. It should be recognized, however, that since the life expectancy of any electronic component decreases with increased ambient temperature, reduction of the ambient temperature will bring about extended component life. For example, longer component life should be expected if the ambient temperature is held between 20°C (68°F) and 30°C (86°F).

WARNING

EQUIPMENT SHOULD NEVER BE INSTALLED WHERE HAZARDOUS, INFLAMMABLE OR COMBUSTIBLE VAPORS OR DUSTS ARE PRESENT UNLESS IT IS EXPLOSION PROOF RATED EQUIPMENT.

Drive system power units equipped with filters are suitable for most factory areas where other industrial equipment is installed. Locations subject to steam vapors or excess moisture, oil vapor or chemical fumes should be avoided. Power units should be installed in a well-ventilated area not subject to excessive heat.

Be sure to protect the interior equipment from metal particles when cutting or drilling entrances for interconnection wiring and cables.

It is recommended that the signal leads be isolated or separated from power leads by using separate conduits. The input speed command (reference) and tachometer feedback (if supplied) or other external feedback signals be twisted pairs with at least ten twists per foot or twisted shielded cable with the shield grounded at only one end. Reference the elementary or interconnection diagram.

If additional relays or contactors are added in the SCR equipment enclosure, RC suppression networks should be added across the coils.

CAUTION

DO NOT USE POWER FACTOR CORRECTION CAPACITORS WITH THIS EQUIPMENT WITHOUT CONSULTING THE SPEED VARIATOR PRODUCTS DEPARTMENT, GENERAL ELECTRIC COMPANY. DAMAGE CAN RESULT FROM HIGH VOLTAGES GENERATED WHEN CAPACITORS ARE SWITCHED.

Before power is applied to the drive system, checks should be made to see that all internal connections are tight, that plug-in printed circuit cards are fully seated and that all open relays and contactors operate freely by hand. Check that the equipment is clean and that no metal chips are present.

Equipment Operation

Erratic or abnormal equipment operation due to some environmental conditions and suggested remedies are listed in the following environmental checklist:

ENVIRONMENTAL CHECK LIST*

CONDITION	POTENTIAL PROBLEM	SUGGESTED REMEDIES
Electrical Power Line		
"Soft" ac power lines droop under steady state load or when heavy loads—such as large induction motors or electric arc welders—are applied.	Can affect unregulated power supplies; can drop ac line voltage out of limits specified for drive equipment (+10%, —5%); can cause fuse blowing on static regenerative drives.	Stiffen up source (substation, etc.); shift load to different load center.
Noisy ac line, full of voltage "spikes" or "holes"; high frequency noise generated by SCR drives on ac feeder; transient high voltages on line.	Can cause SCR misfiring, erratic system performance/operation; overvoltages can destroy semiconductor devices, other components.	Shift to less noisy load center; suppress noise source or drive system if practical; use isolation transformer on offending system.
"Stiff" ac line (high short circuit capability).	Can be hazardous to equipment and personnel due to high short circuit current levels.	Provide adequate short circuit protection between drive and substation.
Line voltage dips for several cycles or disappears entirely, single or polyphase, due to lightning strikes on transmission lines; ac supplied through collector rings or shoes.	Equipment may be shut down, blow fuses, or behave intermittently.	MG set can provide some ride-through due system inertia (flywheel effect).
Electrical Noise		
"Noisy" power conductors induce noise into low level signal wire by coupling; operating relays produce noise; improper shielding or no shielding of low level signal leads can affect drive operation.	Any noise inserted into regulator or firing circuitry can cause misfiring, fuse blowing, and erratic drive operation.	Isolate signal leads from power leads, place in separate conduits; if leads must cross, cross at right angles; provide shielded twisted leads for all low level signals; ground shield at one end of cable only; ground power unit cabinet; suppress relay coils.
Mechanical Vibration		
Equipment subjected to vibrations external to system such as coupling misalignment, belt or chain drive whip, sprocket run-out, misaligned or eccentric rolls; drive vibrates due to vibrations from nearby equipment such as slow speed compressor.	Can generate signals each revolution, causing apparent electrical system instability; can cause general deterioration of connections and wire breakage; can shorten life of bearings in drive motor.	Realign rotating members; shorten belt lengths; true up driven rolls; isolate system from external vibrating masses.
Equipment subjected to vibrations generated within systems such as large starters or contactors being operated.	Can cause general deterioration of terminations, wiring connections, wire breakage; parts can be shaken loose and dropped onto devices, reducing electrical clearances; contact tips of low level signal relays can bounce, producing erratic drive operation.	Isolate vibration sensitive devices; relocate offending devices, dampen vibrations by using some form of rubber cushioning.
Motor bearings are noisy, indicating wear due to vibration.	Can cause short brush life and poor commutation.	Replace bearings and remove any motor load vibration that may lead to further bearing failure.

CONDITION	POTENTIAL PROBLEM	SUGGESTED REMEDIES
Atmospheric Effects		
Temperature is too high due to adjacent heat sources such as ovens, process heat, or exhaust from other equipment; air flow blocked or restricted.	Can cause drifting of regulated paramenters such as speed, higher than normal card and/or component failure, reduced motor bearing life, or shortened insulation life.	Remove heat source; relocate equipment; supply cooler air; remove any obstructions; keep filters clean; flood with conditioned air during extended downtime.
Temperature is too low in operating area; prior to installation, drive is stored in unheated warehouse.	Can cause accumulation of frost or moisture inside power unit/motor, poor regulation, ground hazards, or fuse blowing. Some semiconductors and capacitors can deteriorate. SCR's become more difficult to fire retiably. Rust can form on devices and equipment.	Supply space heaters for sustained storage or operation at low temperatures. Minimum storage temperature —20°C, minimum operating temperature is 10°C usually.
Accumulation of dust or dirt in power unit, oil vapors in air, motor, or filters.	Particulate matter can reduce contact clearances on terminals and relays; contacts can become contaminated; leakage paths can be formed; contacts can close but not make circuits; motor brush life can be reduced; ground hazards can exist; motor temperature or power unit can be elevated due to improper air flow.	Maintain filters on a planned basis; inspect power unit and motor for dirt accumulation; clean equipment, but avoid use of air hoses that may be contaminated with oil particles; remove equipment from dirty air paths or use air ducts to bring in clean air.
Excess humidity in area caused by water vapor or steam from process; condensation from water and steam pipes; area humidifying equipment set too high.	Can cause collection of moisture in power unit or motor, rusting, reduction in creepage paths, or ground hazards.	Locate equipment in less humid area; remove source of moisture or shield drive equipment.
Process vapors combine with moisture in air to form corrosive chemicals such as hydrogen, sulfide, chlorine compounds, sulfur dioxide mixtures; silicone vapors in air.	Can cause corrosion of contacts, electrical components and printed circuit card tabs etchings; can cause deterioration of motor insulation and commutator films; high resistance; can cause ground hazards.	Supply clean air to equipment; add special motor enclosures; place equipment in clean environment—such as in a motor control center.

*This Check List supersedes the one in GER-2862.

Equipment Maintenance

Periodically inspect the equipment filters (when supplied) and change or clean when required. Be sure to install filter with the air flow direction as indicated on the filter. Check all electrical connections for tightness, look for signs of poor connections or overheating (arcing, discoloration) and manually check cooling fans or blowers for easy rotation (if supplied).

Equipment Cleaning

SCR Conversion Modules, Assemblies, Relays and Contactors

1. Dry dust—Vacuum clean, then blow with dry, filtered compressed air (low pressure).

CAUTION

SOLVENT CAN HARM NON-METAL COMPONENTS.

2. Oily dirt—Use dry or barely moist (with solvent) non-linting cloth. Repeat until cloth remains clean. All contact tips must be cleaned with dry non-linting cloth after solvent has been used. Recommended solvent: Freon TE or TF (E.I. DuPont Co.).

Regulator and Printed Circuit Cards

1. Dry dust—Vacuum clean, then blow with dry, filtered compressed air (low pressure supply).
2. Oily dirt—Certain components (electrolytic capacitors, switches, meters, potentiometers and transformers) can be damaged by solvent, so its use is not recommended. If necessary, use solvent sparingly on a small brush, and avoid above components. Clean contact terminals with dry non-linting cloth after solvent has been used.
3. If the card is badly contaminated or corroded, replace.

Air Filters

To clean metal filters, flush only with warm water, dry and recoat lightly with RP Super Filter Coat or equivalent (light oil) or replace the filter.

Motors

Motor maintenance is covered by the motor instruction book supplied with the motor and should be followed in all cases. If the motor is supplied with filters be sure to check and clean or replace periodically.

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