INSTALLATION
OPERATION
MAINTENANCE

DO NOT STORE GRAY PVC ULTRA-MACT IN DIRECT SUNLIGHT

Ultra-Mact™—Dry Scrubber Composite Mesh Pad (CMP) with H.E.P.A. Filter

Ultra-Mact™

PO Box 5319
281 Hughes Drive
Traverse City, MI 49686

Ph:231-941-5865
Fax: 231-941-1636
mapco@midwestair.com

JOB NO: _____

CUSTOMER: _____

APPLICATION: _____

MIDWEST AIR PRODUCTS CO., INC.
TRAVERSE CITY, MI

INDEX

CAUTION

This equipment can cause serious bodily injury. Severe damage could occur to the equipment, surrounding property and automobiles. Before operating this equipment read the Installation, Operation and Maintenance Instructions.

This unit will malfunction If:

1. Spray nozzles become plugged.
2. Recirculation system is not operating properly.
3. Washdown schedule is not maintained.
4. Mesh pads are loaded with concentrated chrome.
5. Proper velocity is not maintained.
6. Mesh pads are damaged or out of alignment.
7. H.E.P.A. filters are wet or damaged.

Due to the toxic and highly corrosive nature of chromic acid, mechanical recirculation accessories, plumbing, etc. can and will eventually fail possibly causing a spill. Mapco recommends ***secondary containment*** for chrome scrubber, recirculation system, supply and waste plumbing.

1. Open access door and check all mesh pads for separation between scrubber side wall and or mesh pad retainer. Also check mesh pad and H.E.P.A. filters for voids or deterioration. Any opening or gap in mesh pad could allow mists to bypass mesh pads.
2. Plumbing - Make sure all plumbing is installed to code. Check for leaks.
3. Fresh water make-up - Make sure the proper amount of fresh water make-up is supplied on a regular basis to the recirculation system or Ultra-Mact ™ to avoid concentration of scrubber liquor.
4. Blowndown - make sure recirculation system is purged regularly to avoid concentration of scrubber liquor.
5. Velocity/CFM - External static pressure for the purposed system has been estimated and may vary depending on actual field conditions. Make sure exhaust fan is exhausting proper volume (CFM). Deviation from design could cause excessive misting at mist eliminator.
6. Spray Pattern - check spray nozzles upon start-up for good spray pattern. Debris lodged in filter media could become dislodged during transit. Without a filtering device, debris could become lodged in spray nozzle causing little or no flow.

Responsible personnel must be assigned to the installation, operation and maintenance of this unit. Read complete manual prior to operating this unit. Observe fan discharge stack immediately after start-up and on a regular basis thereafter. If excessive misting is present, shutdown system immediately and notify MAPCO. Serious damage could occur to property if unit is run under this condition.

Safe operation of this equipment is dependent upon proper operation and regular maintenance. The items listed below should be checked prior to operating this unit and on a regular basis thereafter.

Start-Up Service:

In addition to this installation, operation and maintenance manual, MAPCO offers a factory trained service representative to perform, assist or advise in the installation and start-up of this equipment. The cost for this service can be quoted if desired.

Note: MAPCO assumes the "End User" is knowledgeable of this equipment and fully understands the risks associated with the installation, operation and maintenance of the equipment purchased.

INTRODUCTION - The performance of every MAPCO dry scrubber depends on many factors. The purpose of this manual is to make you aware of these factors so you will obtain the utmost efficient and dependable performance from your MAPCO equipment.

Providing, care is exercised in installing this equipment, and it is given reasonable maintenance, you can be assured of trouble free operation for years to come.

It is important that you study this manual prior to installing and operating this equipment to assure safe installation and operation.

SAFETY - The very nature of air handling equipment and accessories present a hazard to personnel during installation and maintenance. The following precautions should be observed prior to starting and maintaining the scrubber:

1. Inspect the name plate or other tags for special instructions.
2. All system motors should be locked out. This is accomplished by padlocking the disconnect switch in the off position until installation or maintenance is complete.
3. The scrubber housing should be inspected for debris or any loose parts.
4. Installation should be complete with inlet and outlet accessories attached.
5. All guards should be in place and secured. Never remove or replace any guards unless pump is shutdown and locked out.
6. All dampers in duct system should be locked in open position.
7. Never discharge corrosive or harmful fumes from the fan. Scrubber should always be operated with the proper amount of water.
8. Inspect ductwork for leakage of harmful or corrosive fumes.
9. Follow good safety practices when installing or maintaining this equipment.

RECEIVING AND INSPECTION - Upon receipt of shipment, check first to see that all items on bill of lading and/or packing slip have been received. By careful inspection determine whether damage has occurred in transit. Any shortage or damage should be noted and a claim should be filed immediately.

Equipment manufactured by Midwest air Products Co., Inc. has been inspected at our factory in Traverse City, MI.

HANDLING AND STORAGE - If installation of the scrubber is delayed and storage is made outdoors, provide reasonable weather protection. Special attention should be given to pump and motor to prevent the entrance of water. When transporting or installing a scrubber, the lifting eyes should be used to prevent damage.

Never pick a scrubber up by its flanges. Do not tarp equipment or ductwork exposed to direct sun-light. Excessive heat can build-up causing distortion. Motors and pumps supplied with products manufactured by Midwest Air Products Co., Inc. have been test run prior to shipping. All scrubbers have been test run and checked for leaks.

FOUNDATIONS - A rigid, level foundation is vitally essential for operation and good performance of a scrubber. A frequent error is to design a foundation for the weight of the scrubber only. Consideration should be given for weight of the scrubbing liquor.

Poured concrete is preferred to steel or wood. Steel platforms should be heavily braced.

DUCT CONNECTIONS - Duct loads can cause distortion with consequent damage to the scrubber. With this is mind, please observe the following:

1. Support ducts independently of scrubber.

2. Use flexible connections between fan and scrubber.

3. Inlet duct should be supplied with a flanged connection a minimum of 3'-0" from scrubber inlet.

OPERATING TEMPERATURES - The dry scrubber is fabricated from 3/8" thick type I extruded PVC. If process runs a constant temperature exceeding 130^{o} F, other materials should be used.

MATERIALS OF CONSTRUCTION - MAPCO
Dry scrubber shells are fabricated from 3/8" Type I, grade I corrosion resistant, unplasticized PVC. Inlet and outlet flanges are 3/4" thick (when both inlet and outlet are square or rectangular). It is recommended that all chrome control equipment be set up with some form of secondary containment should a leak occur.

GENERAL
1. Prior to installing this equipment inspect the name plates or other tags for special instructions.

2. It is recommended that this equipment be installed by personnel familiar with the installation of this type of equipment.

3. All MAPCO Dry Scrubbers are supplied with an enamel coated steel base. If the scrubber is mounted on a platform, it should be thoroughly braced. If the scrubber is roof mounted, a structural engineer should be consulted to determine if the roof can support the operating weight of the scrubber. This equipment is constructed of P.V.C., Polypropylene or F.R.P. Care should be exercised in handling this equipment during installation to prevent damage caused by external stress or shock.

INSTALLATION INSTRUCTIONS

1. Prior to installation, inspect mesh pads and H.E.P.A. filters for damage during transit. Inspection can be made by looking through the clear inspection doors with the aid of a flashlight. If media is separated from sidewall, consult factory immediately. **DO NOT RUN THE UNIT**.

2. Inspect the interior for debris prior to connecting inlet/outlet transitions, duct, supply and waste plumbing.

3. Inspect all plumbing connections for breakage or leaks.

4. All MAPCO scrubbers are equipped with lifting eyes for rigging. Do not lift P.V.C. scrubbers by the flanges, use lifting eyes.

5. It is recommended that inlet/outlet transitions be bolted on prior to setting the scrubber. Prior to bolting transitions be sure the flanges are clean. Use adhesive backed, closed cell gasket or 100% silicone caulking material supplied with the scrubber. Apply gasket starting at the center of the top flange horizontally. Continue around face of flange to starting point making sure gasket is within the inside of bolt holes. Bolt transitions in place using stainless steel hardware supplied with unit. Bolt holes (if not drilled) should be on 4" or 6" centerlines.

6. After transitions are installed and bolts tightened, working inside the scrubber, apply a sufficient amount of compatible caulking along the bottom at the flange joint and up both sides of inlet and outlet. This method applies for transitions bolted in the horizontal position. Using a putty knife, smooth out the caulking to be sure the joint is completely sealed. This is a precautionary step only. Mapco scrubbers are supplied with 3/4" thick inlet and outlet flanges to promote a good seal and minimize leakage.

7. Install unit on a solid base or platform. Make sure the scrubber is sufficiently elevated to allow effluent to flow back to holding tank or waste treatment.

SUPPLY PIPING - Follow proper plumbing codes when installing plumbing. Double wall containment may be required. DO NOT tap into potable drinking water for supply of clean water. Use the proper back-flow valves, etc. to prevent cross-contamination.

1. The drain is located in the center of the scrubber bottom (in some cases the drain may be located on the side of the unit). It is good practice to install a valve prior to running the drain line.

2. The supply line should be plumbed using sch. 80 PVC or CPVC as a minimum. Pipe supports should be installed to insure solid installation (see plumbing schematic for supply diameter). In most cases the Ultra-Mact™ is installed inside where it is not subject to freezing. If this is not the case, the supply line must be heat traced to avoid freeze up. If the system was not purchased with a recirculation system and pumps are to be used for supply, a check valve should be used on the pump discharge and/or pump suction.

3. The recirculation tank overflow and drain should be plumbed to waste treatment. Install a shut-off valve after drain and prior to overflow if both lines are plumbed to the same line.

4. In order to minimize plugging of the spray nozzles, a filtering device should be installed on the pump discharge of the supply pump to catch any debris. It is good practice to do the same on the pump suction. If not installed, the nozzles will eventually become plugged and cause the mesh pads to plug. This could create undue stress on the mesh pads and allow chrome to bypass the system.

RECIRCULATION SYSTEMS (optional) -Because every application is unique, MAPCO offers several distinct recirculation packages. Depending on how your system was configured and what you purchased, one of the following descriptions should apply. All recirculation systems can be purchased with an (optional) control package for automated operation.

OPERATION IMPORTANT - The polypropylene mesh pads supplied with this unit may contain residual lubricating oil that is used on the knitting needles during pad construction. Mapco knows of no instance where these oils presented a problem involving contamination of the plating bath. To avoid any possibility of plating bath contamination, effluent from initial pad washdowns should be sent to waste treatment until foamy brown traces of oil disappear.

Inadequate washdown procedures and/ or excessively high concentrations of chrome may considerably shorten the service life of polypropylene mesh pads. This is especially true for the first phase mesh pad. Mapco offers as a standard, a more expensive mesh pad constructed partially of of Kynar®. Kynar® offers a higher degree of resistance to chromic acid and should significantly increase the life expectancy of the first phase pad. These pads are standard equipment. Replacement Kynar® mesh pads cost run three to five times that of polypropylene.

PRE-FILTER - The Ultra-Mact™ is designed to operate with either an in-line mist eliminator, a mesh pad installed in the exhaust hood (Terminator™ fume hood), or an additional pre-filter mesh pad section incorporated directly into the lower section of the Ultra-Mact™ shell. In all cases, this pre-filter acts as a coalescer to remove large droplets of chromic acid from the air stream before the air enters the Ultra-Mact™ . Due to the high loading of the pre-filter, it will require the most washdown cycles. When washed down, the chrome effluent should be directed back to the plating tank or a holding tank.

ULTRA-MACT™ WASHDOWN SCHEDULE (FREQUENCY AND DURATION)
The Ultra-Mact™ is designed with three stages (four if the pre-filter is incorporated within the Ultra-Mact™). The first stage is directly above the inlet. The second and third (optional fourth) stages are directly above the first. As the air passes through each stage a percentage of chrome is removed. The first stage will collect the highest percentage of larger chrome droplets and therefore will require more washdown cycles. The last stage H.E.P.A. filters will not require a washdown. Through each stage a percentage of chrome is removed. The second stage will require fewer washdown cycles than the first.

PHASE I WASHDOWN (IF PRE-FILTER IS INSTALLED, IF NOT, PHASE I APPLIES TO FIRST STAGE OF COLLECTOR) - The pre-filter (first stage), in most cases will require a washdown every two to three hours. The duration of the washdown will last from 30 - 45 seconds. This can be determined by visual inspection of the effluent. When the water is clean the washdown duration will be established.

PHASE II WASHDOWN - The first stage of the Ultra-Mact™, will require a washdown every three to four hours. The duration of the washdown will last from 30 - 45 seconds. This can be determined by visual inspection of the effluent. When the water is clean the washdown duration will be established.

PHASE III - The second stage of the Ultra-Mact™, will require a washdown. every four to eight hours. The duration of the washdown will last from 15 - 30 seconds. This can be determined by visual inspection of the effluent. When the water is clean the washdown duration will be established.

PHASE IV WASHDOWN (optional) - The fourth stage will require a washdown once a day. The duration of the washdown will last from 15 - 30 seconds. This can be determined by visual inspection of the effluent. When the water is clean the washdown duration will be established.

The final stage H.E.P.A. filter does not require a washdown and should be kept dry.

Proper washdown of the mesh pad will be indicated when effluent produced from washdown runs clear at the end of the wash cycle. For situations involving very light loadings of chromic acid, it may be possible to decrease washdown frequency and/or duration. Concentrated effluent will indicate the need for more frequent or longer duration washdown of the mesh pad.

START-UP - After starting the unit and making all adjustments to the exhaust system it is important that you document the initial pressure drop as indicated on the magnehelic or photohelic gauge located on the side of the Ultra-Mact™ or control panel. The reading recorded will be the proper static pressure this unit should operate under. Any deviation in this measurement will indicate a potential problem with the system.

PREVENTATIVE MAINTENANCE - The Ultra-Mact™ requires minimal maintenance when operated and maintained according to instructions. Until you have run this equipment for a few months and are totally familiar with its operation, Mapco recommends you perform the following inspections on a weekly or bi-weekly basis. When you have a good grasp on how the system functions, the inspections can be made during scheduled down time. Mapco recommends quarterly inspections as a minimum.

NOTE: Use the appropriate safety equipment, clothing and eye protection. Follow manufacturers recommended safety procedures for safe handling of all chemicals and other potential hazards.

A. SPRAY NOZZLES - Spray nozzles should be visually checked for proper spray pattern. The spray pattern should give the appearance of a full cone for each nozzle. If the pattern appears to be erratic, the spray header and nozzle assembly should be removed from the unit and cleaned. Improper or no spray can cause severe plugging and deterioration of the mesh pads. Mapco recommends the use of a strainer in the main header line to minimize nozzle plugging.

1. Shut off water supply to spray header. Shut system down and lockout all electrical panels, switches or disconnects. Follow proper safety procedures to insure against header discharge while working on spray header.

2. Remove bolts securing header flange to sidewall of scrubber. Break apart union connection at main spray header. Take all necessary precautions to avoid spillage of solution. Spray nozzles typically point up, rotate header 180^0 to allow drainage. Be sure solution has completely drained from header. Pry header away from backing plate. Exercise caution to avoid breaking header flange when removing or prying. Remove header from unit.

3. Remove threaded end cap and all spray nozzles from spray header. Remove all debris from nozzles and header.

4. Reverse above steps and re-install. Make sure header flange and backing plate are secured and leak proof. Mapco recommends the use of a 100% silicone caulking and /or Teflon gasket.

B. MESH PAD FILTER MEDIA

Mesh pads should be checked for plugging, build-up or separation from retainer. Under normal circumstances, the mesh pad filter media requires minimal maintenance, provided, the spray nozzles, washdown schedule, and washdown concentration are maintained. Other factors that may accelerate plugging are minerals in the washdown liquor such as calcium or small dust particles present in the plant air from grinding operations, etc. Should the unit be operated for periods without water, or fine particles are present in the plant air, the mesh pads will eventually plug and/or deteriorate. If mesh pad becomes plugged, remove and clean.

1. Shut system down and lockout all electrical panels, switches or disconnects. Follow proper safety procedures.

2. Rinse pads thoroughly with clean water.

3. Remove stainless steel bolts holding mesh pad access doors to unit. In some cases doors are sealed with caulking which could cause door to stick to frame. With a pry bar, gently pry on door and remove slowly. Excess pressure will break door.

4. Grasp mesh pad retainer through finger holes or handles and gently pull. Depending on retainer size it may be necessary to utilize other equipment or additional man power to remove pad.

5. Rinse pad in rinse tank or clean with high pressure hose. Wear proper safety equipment and follow proper procedure for chemicals involved. Make certain pad has not deteriorated, plugged or pulled away from retainer frame. Check for holes in pad.

6. After pad is thoroughly cleaned, gently slide retainer back into unit. When all pads are replaced apply 100% silicone caulking to outward side of backing flange bolt holes. Check for gap between retainer and access door. If a gap is present, apply caulking or gasket to fill void. Apply 100% silicone caulking to inward side of bolt holes and allow to skin over. Apply door making sure alignment marks are lined up. Make sure all bolts are started prior to tightening bolts. Do not over tighten bolts.

IMPORTANT NOTE: Mesh pads do not last forever and replacement is inevitable. Under no circumstances does Mapco recommend or approve of mesh pads being installed by other.

If mesh pads are installed by other than Mapco personnel, Mapco shall in no event be liable for incidental or consequential damages, nor for special damages resulting from improper installation of mesh pads.

RECOMMENDED SPARE PARTS - Sooner or later something is going to wear out or fail. When your ventilation system is down your process usually goes with it. Too often we see our customers spending premium dollars to expedite replacement parts to get their line running. Most associated parts of your chrome scrubber and/or fan can be shipped within a few days to a week. The following spare parts require longer than usual lead time:

1. Mesh pads and retainers
2. Fan wheel and shaft
3. H.E.P.A. filters

These parts are typically long lead items (three to six weeks) that may require an extended shut-down period should they fail.

Mapco strongly recommends that these parts be carried in your inventory of spare parts.

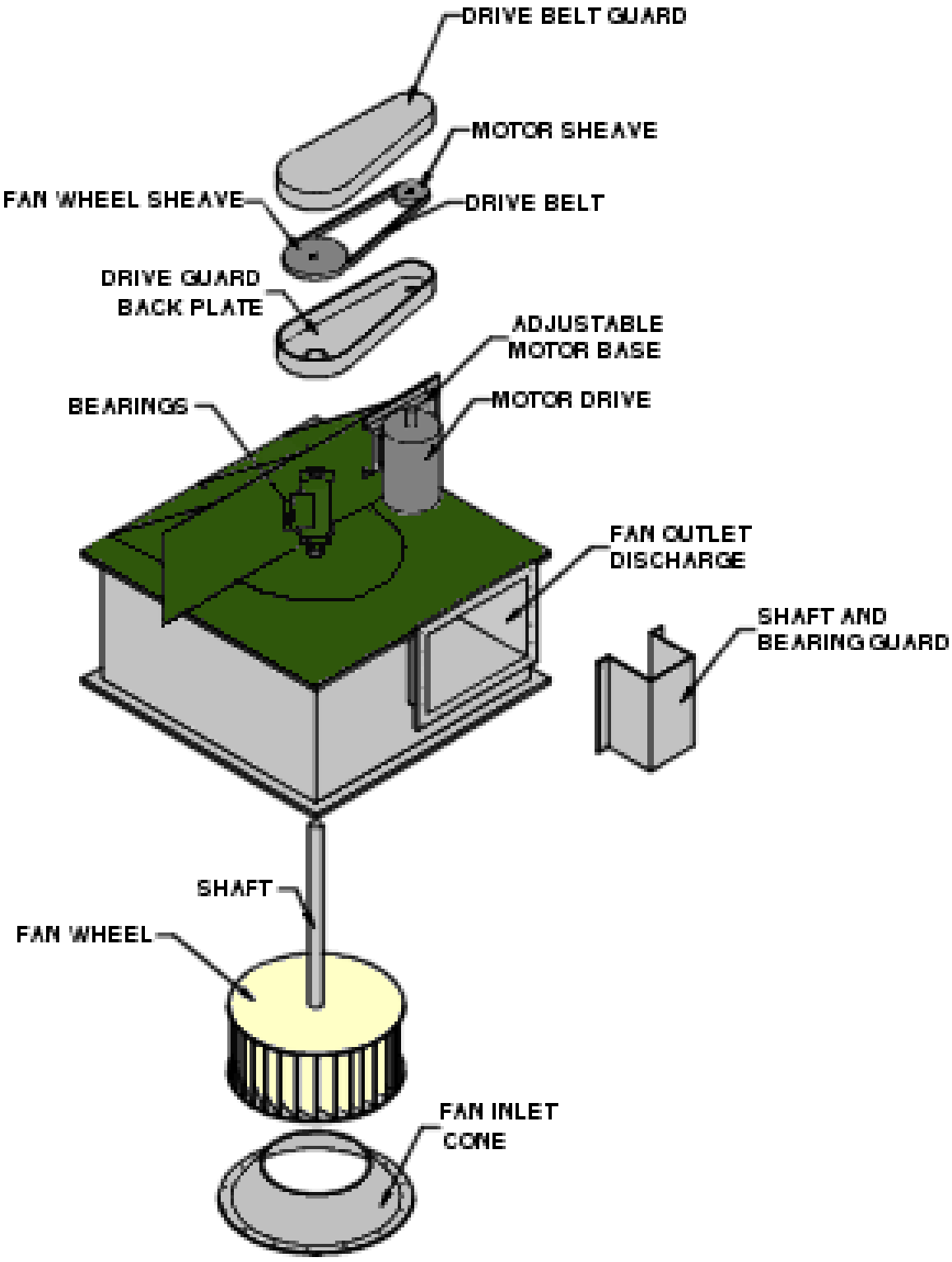
TROUBLE SHOOTING

PROBLEM	POSSIBLE CAUSE
POOR SPRAY PATTERN	• Spray Nozzles plugged up • Spray Headers plugged up • Pump suction blocked • Pump discharge piping too small • Insufficient water in sump • Pump running backwards • Total head exceeds that of pump
UNIT WILL NOT DRAIN	• Drain line to remote tank is not submerged or trapped • Drain line is not sloped towards tank • Drain line plugged • Drain line too small
MOISTURE AFTER UNIT	• Re-Entrainment due to liquid loading • H.E.P.A. filter wet or damaged • Mist Eliminator damaged • Velocity too high through scrubber • Droplet size too small • Build-up of chrome on Mist Eliminator • Mesh pad mist eliminator plugged or saturated—liquid loading too high—throttle back nozzle spray pattern—clean mesh pad
LOW REMOVAL EFFICIENCY	• Insufficient or no water to spray nozzles • Mist Eliminator plugged or shifted • Velocity too high or too low • H.E.P.A. filter wet or damaged
DECREASED EXHAUST VOLUME—EXHAUST SYSTEM NOT VENTING PROPERLY	• Check fan—RPM—belts—rotation—fuses • Insufficient air make-up in building • Dampers closed or broken in closed position • Ductwork plugged with solids • High negative pressure in building • Leaks in ductwork • System static pressure too high
OILY SOLUTION IN PLATING BATH	• Residual oils used in manufacture of mesh pads. Run several washdown cycles on each phase until clean.
DETERIORATION OF MESH PAD	• No water to spray nozzles • Spray nozzles plugged • Concentrated chrome build-up • Chrome bath includes chemicals not compatible with chrome

Due to the high efficiency of composite mesh pads, plugging can occur from the following sources:

1. Grinding dust.
2. Minerals deposit from water supply.
3. Flux from soldering or welding process.

Ultra-Mact


DRIVE BELT GUARD
MOTOR SHEAVE
FAN WHEEL SHEAVE
DRIVE BELT
DRIVE GUARD
BACK PLATE
ADJUSTABLE
MOTOR BASE
BEARINGS
MOTOR DRIVE
FAN OUTLET
DISCHARGE
SHAFT AND
BEARING GUARD
SHAFT
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CAUTION

This equipment can cause serious bodily injury and/or property damage. Responsible personnel must be assigned to the Installation, Operation and Maintenance of this equipment. Before operating this equipment, thoroughly read the installation, operation and maintenance instructions.

Before putting fan into operation:

1. Tighten all set screws in bearings and sheaves. Repeat after 8 hours operation. Repeat again after 2 weeks. Check and tighten bolts on bearings, motor, motor base and fan housing.

2. Inspect bearings, sheaves and belts for alignment.

3. Rotate fan wheel by hand to check for free rotation. Check for shifting of wheel and shaft.

4. Inspect all accessories to insure connections are tight.

5. Do not operate fan without all guards in place.

6. Do not remove guards while fan is running.

7. Check for correct rotation of fan wheel by bumping starter momentarily. Wheel should rotate in same direction of fan outlet.

8. Check for excessive vibration. If vibration is evident, shut fan off and determine cause. Do not operate Fan until source of vibration is determined and corrected.

9. Velocity/CFM - Make sure exhaust fan is exhausting proper CFM. Higher CFM than design could cause excessive misting at the scrubber outlet.

Any malfunction of the exhaust fan should be reported to MAPCO immediately for repair or service instructions.

Start-Up Service:

In addition to this installation, operation and maintenance manual, MAPCO offers a factory trained service representative to perform, assist or advise in the installation and start-up of this equipment. The cost for this service is charged per man at the following rates:

A.	First eight (8) hours of a single day	$50.00/hour
B.	Overtime hours in a single day	$65.00/hour
C.	Sunday or Holiday	$80.00/hour

D. Other expenses such as airfare, hotel, car rental, meals, parts, tax, freight, etc. if applicable will be charged at cost plus 15% administration fee.

E. Company Vehicles
1. Company car or truck @ $.50/mile
2. Company truck and trailer @ $1.50/mile

Note: MAPCO assumes the "End User" is knowledgeable of this equipment and fully understands the risks associated with the installation, operation and maintenance of the equipment purchased.

INTRODUCTION

The performance of every MAPCO fan depends on many factors. The purpose of this manual is to make you aware of these factors so you will obtain the utmost efficient and dependable performance from your MAPCO equipment. Providing, care is exercised in installing this equipment, and it is given reasonable maintenance, you can be assured of trouble-free operation for years to come.

Because it is not always possible to completely protect the careless worker, it is important that you study this manual prior to installing and operating this equipment to assure safe installation and operation.

SAFETY

The very nature of air handling equipment and accessories present a hazard to personnel during installation and maintenance. The following precautions should be observed prior to starting and maintaining the fan:

1. The fan motor should be locked out. This is accomplished by padlocking the disconnect switch in the off position until installation or maintenance is complete.

2. The fan housing should be inspected for debris or any loose parts.

3. Installation should be complete with inlet and outlet accessories attached.

4. All guards should be in place and secured. Never remove or replace any guards unless fan is shutdown and locked out.

5. Do not open access doors while fan is in operation. Fan should be locked out prior to servicing or inspecting fan wheel and other rotating parts.

6. Never remove or replace wheels, sheaves or shaft without thoroughly studying specific instructions.

7. Never pry a belt over the edge of a sheave to remove or replace it. This could result in a cracked sheave.

8. All dampers in duct system should be locked in open position.

9. Never discharge corrosive or harmful fumes from the fan. Install proper air cleaning equipment as required by local authorities

10. Inspection of fan wheel, bearing and drive should be performed on a regular basis. Inspect for corrosion which could result in mechanical failure. Any corroded parts should be replaced immediately.

11. Inspect ductwork for leakage of harmful or corrosive fumes.

12. Follow good safety practices when installing or maintaining this equipment.

All equipment manufactured by Midwest Air Products Co., Inc. has been thoroughly tested and inspected at our factory in Traverse City, Michigan. All fans are dynamically balanced and test run at the operating R.P.M.

RECEIVING AND INSPECTION

Upon receipt of shipment, check first to see that all items on bill of lading and/or packing slip have been received. By careful inspection determine whether damage has occurred in transit. Any shortage or damage should be noted and a claim should be filed immediately.

HANDLING AND STORAGE

If installation of the fan is delayed and storage is made outdoors, provide reasonable weather protection. Special attention should be given to bearings to prevent the entrance of water. When transporting or installing a fan, the lifting eyes should be used to prevent damage. Never pick a fan up by its shaft.

FOUNDATIONS

A rigid, level foundation is vitally essential for smooth, quiet operation and good performance of a fan. A frequent error is to design a foundation for the weight of the fan only. Consideration should be given for live load due to rotating equipment.

Poured concrete is preferred to steel or wood. Concrete foundations should have a minimum weight of five times the total weight of the fan. Steel platforms should be heavily braced for live load support. When a solid surface is not practical, fans should be mounted on vibration isolators.

DUCT CONNECTIONS
Duct loads can cause fan distortion with consequent rough operation and damage. With this in mind, please observe the following:

1. Support ducts independently of fan.

2. Use flexible connections.

3. Inlet duct should be supplied with a flanged connection approximately 3' to 5' from fan inlet allowing convenient removal of wheel. An inspection door is recommended for viewing fan inlet cone.

OPERATING TEMPERATURES
1. PVC fans should not be used on constant temperatures exceeding 130^{o} F.

2. FRP fans should not be used on constant temperatures exceeding 160^{o} F.

OPERATION
Prior to operating the fan the following preoperative checks should be made:

1. Rotate fan wheel by hand to check for free rotation. Check for shifting of wheel and shaft which might have occurred in transit.

2. Inspect all accessories to insure connections are tight.

3. Inspect fan housing for debris.

4. Inspect bearings, sheaves and belts for alignment. Also check set screws on bearing and sheaves.

5. Connect motor to proper power source as indicated on motor nameplate.

6. Check for correct rotation of fan wheel by bumping starter momentarily. Wheel should rotate in same direction as indicated by arrow on fan housing. If fan rotates opposite arrow re-wire according to wiring instructions.

7. Check fan for excessive vibration. If vibration is evident shut fan off and determine cause. DO NOT operate until the source of vibration is eliminated.

8. Check current draw of motor with amperes shown on motor nameplate. Do not operate motor under overload conditions as this could cause motor to fail and void manufacturer's warranty.

9. Re-check all set screws and bolts after 8 hours of operation and again after 2 weeks.

PREVENTATIVE MAINTENANCE
1. FAN WHEEL -The fan wheel should be inspected periodically to insure no build-up has occurred. Build-up is more likely to occur when there is no air cleaning device prior to fan inlet. Chemical deposits that are allowed to build-up will eventually break away in pieces. When this happens the fan may be thrown out of balance resulting in serious vibration and damage to the fan. Care should be taken when removing chemical deposits. Never use sharp objects that could affect the integrity of the wheel coating. If the chemical barrier has been damaged and corrosion is evident, replace the wheel immediately.

2. **SHEAVES** - Sheave grooves should be smooth and uniform. Burrs should be filed off to prevent belt damage. Periodically check set screws or bolts to insure they are tight.

3. **BEARING AND MOTOR LUBRICAT**ION Set up lubrication schedule according to manufacturer's instructions. (See Bearing section)

4. **MOTOR** - Inspect motor periodically for dirt build-up. A clean motor runs cooler. Inspect bearings for roughness by disconnecting motor from fan wheel and turning by hand. Note: Be sure fan motor is locked out prior to inspecting motor.

MAINTENANCE
1. Check for material build-up on fan wheel. If build-up is present, remove by one or all of the following:

A. High pressure washer

B. Scrape wheel with blunt object. Do not use sharp object which could damage coating.

2. Check for de-lamination of wheel weight. If wheel throws a weight consult factory for location and method of attaching weight.

3. Check for defective bearings. In most cases where excessive vibration is present, it is due to the bearing seizing up and fan shaft spinning in bearing race. If allowed to run under this condition, the shaft will wear and cause imbalance. (See bearing section)

4. Check alignment of sheaves. (See alignment of sheaves)

5. Check static pressure. If static pressure is lower than specified, the fan will produce additional CFM and excessive vibration.

6. Check motor. Motor could have defective bearings.

LUBRICATION

SLX BEARINGS are lubricated at the factory and requires no further lubrication.

SC, SCB, SCM, SXR, SXRB BEARINGS

Storage or Special Shutdown - If exposed to wet or dusty conditions or to corrosive vapors, extra protection is necessary: Add grease until it shows at the seals; rotate the bearing to distribute grease; cover the bearing. After storage or idle period, add a little fresh grease before running.

High Speed Operation - In the higher speed ranges too much grease will cause overheating. The amount of grease that the bearing will take for a particular high speed application can only be determined by experience - see "Operating Temperature" below. If excess grease in the bearing cause overheating, it will be necessary to remove grease fitting to permit excess grease to escape. The bearing has been greased at the factory and is ready to run. **When establishing a re-lubrication schedule, note that a small amount of grease at frequent intervals is preferable to a large amount at infrequent intervals.**

Operation in Presence of Dust, Water or Corrosive Vapors - Under these conditions the bearing should contain as much grease as speed will permit since a full bearing with consequent slight leakage is the best protection against entrance of foreign material. In the higher speed ranges too much grease will cause overheating - see "High Speed Operation" above.

In the lower speed ranges it is advisable to add extra grease to a new bearing before putting into operation. Bearings should be greased as often as necessary (daily if required) to maintain a slight leakage at the seals.

Average Operation - The bearings has been greased at the factory and is ready to run. The following table is a general guide for relubrication. However, certain conditions may require a change of lubricating periods as dictated by experience. See "High Speed Operation" and "Operation in Presence of Dust, Water or Corrosive Vapors" above.

Operating Temperatures - Abnormal bearing temperatures may indicate faulty lubrication. Normal temperature may range from "cool to warm to the touch" up to point "too hot to touch for more than a few seconds" depending on bearing size and speed and surrounding conditions. Unusually high temperature accompanied by excessive leakage of grease indicates too much grease. High temperature with no grease showing at the seals, particularly if the bearing seems noisy, usually indicates too little grease. Normal temperature and a slight showing of grease at the seals indicate proper lubrication.

Kind of Grease - Many ordinary cup greases will disintegrate at speeds far below those at which Dodge bearings will operate successfully if proper grease is used. Dodge bearings have been lubricated at the factory with No. 3 consistency lithium base grease which is suitable for normal operating conditions. Re-lubricate with lithium base grease or a grease which is compatible with original lubricant and suitable for ball bearing service. In unusual or doubtful cases the recommendation of a reputable grease manufacturer should be secured. See table on the following page.

LUBRICATION SCHEDULE

Read preceding paragraphs before establishing lubrication schedule

Suggested lubrication period in weeks

Hours Run Per Day	1 to 250 RPM	251 to 500 RPM	501 to 750 RPM	751 to 1000 RPM	1001 to 1500 RPM	1501 to 2000 RPM	2001 to 2500 RPM	2501 to 3000 RPM
8	12	12	10	7	5	4	3	2
16	12	7	5	4	2	4	1	1
24	10	5	3	2	1	1	1	1

V-BELT DRIVES

1. INSTALLATION OF SHEAVES

A. Insert bushing into sheave and loosely insert cap screws. Be sure surface of taper lock bushing is clean and free of foreign mate-rials.

B. With cap screws heads facing the outside, slide assembly on to shaft making sure the key stock is aligned with key way in shaft.

C. After both sheaves are in position align with a straight edge or string as indicated. Rotate each sheave 180^0 and check until secure. Re-check alignment.

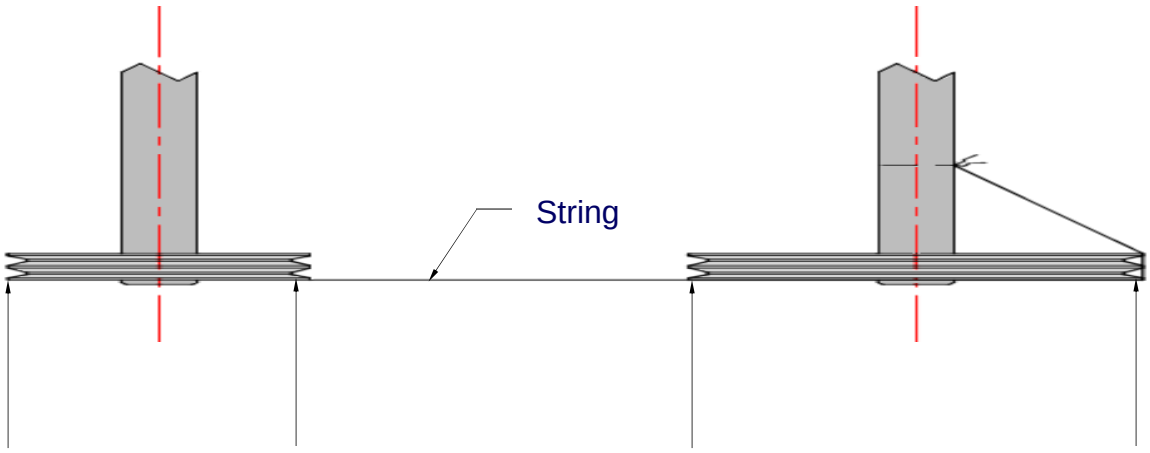
2. REMOVAL OF SHEAVES

A. Remove belt guard and relieve belt ten-sion.

B. Back out cap screws and insert into tapped holes in sheave. Progressively tighten until sheave separates from bush-ing.

C. Remove bushing and sheave.

DANGER: <u>DO NOT</u> INCREASE FAN RPM WITH-OUT CONSULTING FACTORY. SERI-OUS DAM-AGE COULD RESULT TO PER-SON-NEL AND EQUIPMENT.



Using a string or a straight edge, align sheaves by touching all four points as indicated by arrows.

3. VARIABLE PITCH SHEAVE ADJUSTMENT

A. Remove belt guard and relieve belt tension.

B. Loosen set screw and remove key stock, allowing adjustable section to turn.

C. Turn adjustable section in for a larger pitch diameter (increased speed), or out for a smaller pitch diameter (decreased speed). Every one-half turn will change the pitch diameter by one-tenth of an inch. Multiple groove sheaves should be adjusted the same amount of turns.

D. Replace key stock and tighten set screw to lock sheave in place.

Note:

When adjusting for higher fan speeds, check motor current to be sure readings are within name plate and service factor ratings.

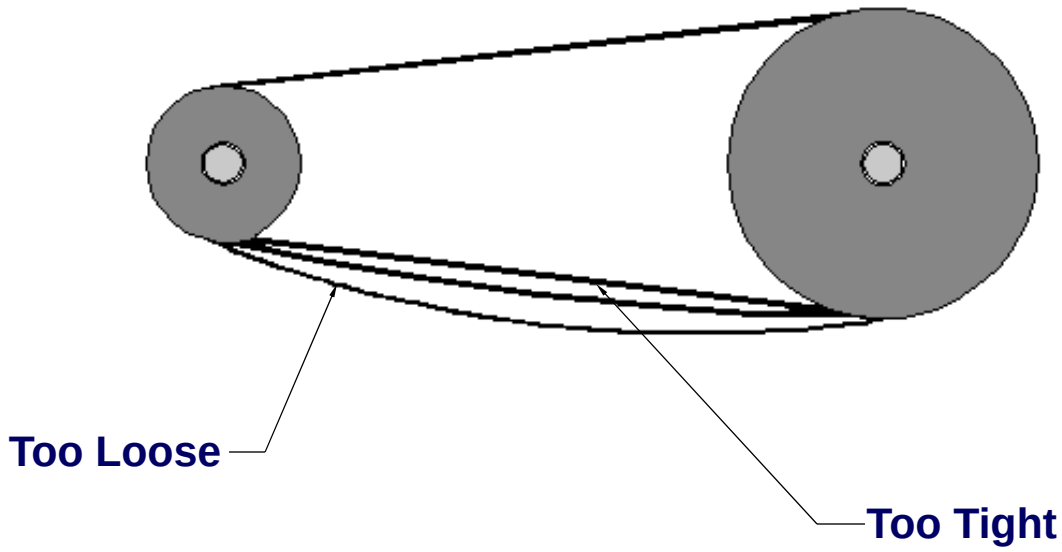
BELT INSTALLATION

1. With all belts in their proper grooves adjust the motor to take up all slack until the belts are fairly taut.

2. Start the drive and check belts under load. The belts should have a slight bow as indicated below.

3. After a few days of operation the belts will seat themselves in the sheave grooves. It may be necessary to readjust so that the drive again shows a slight "bow" in the slack side.

FIXED DRIVE



MOTORS

1.GENERAL

Read motor nameplate and check power supply to be sure voltage, frequency and current carrying capacity are correct. Motors indicating 208/220/ 440 volts can be operated on 208, 220 or 440 volt lines. This type of motor, when operated with 208volts at the motor terminals, will deliver approximately 11% less locked motor and breakdown torques and draw up to 4% more line current at rated load as compared with 220 volts at the terminals. The motor will perform satisfactorily on voltage variations of plus/minus 10%, or frequency variation of plus/minus 15% of the name plate rating, or a combine voltage and frequency of 10%. These variations do not apply to 208 volt rating of motors stamped with 208-220/-440 volts.

2. WIRING

Connect the motor to the power supply according to the diagram on the connection plate. Connections should be clean and tightly bolted.

To reverse the direction of rotation of a three phase motor, interchange any two of the line wires to the motor leads. Two phase motors are reversed by inter-changing T-1 and T-3 or T-2 and T-4.

3. **LUBRICATION**

Follow manufacturer's literature.

4. TYPICAL MOTOR CURRENT AND STARTER SIZE

Amperes as indicated in chart are nominal and were used for sizing starters only. **DO NOT** use these values for sizing heaters or other overload protection. Refer to motor nameplate for actual motor current and refer to the heater size chart for actual starters used. Actual conditions under which the starters will operate must be considered when sizing overload heaters. It may be necessary to increase heater size when starters are enclosed or exposed to radiant heat.

HP	Three Phase						Single Phase			
	230 Volts		460 Volts		575 volts		115 volts		230 volts	
	Amps	Starter	Amps	Starter	Amps	Starter	Amps	Starter	Amps	Starter
1/2	2	00	1	00	.8	00	9.8	0	4.9	00
3/4	2.8	00	1.4	00	1.1	00	13.8	0	6.9	00
1	3.6	00	1.8	00	1.4	00	16	0	8	00
1 1/2	5.2	00	2.6	00	2.1	00	20	1	10	0
2	6.8	0	3.4	00	2.7	00	24	1	12	0
3	9.6	0	4.8	0	3.9	0	34	2	17	1
5	15.2	1	7.6	0	6.1	0	56	3	28	2
7 1/2	22	1	11	1	9	1	80	3	40	2
10	28	2	14	1	11	1			50	3
15	42	2	21	2	17	2				
20	54	3	27	2	22	2				
25	68	3	34	2	27	2				
30	80	3	40	3	32	3				
40	104	4	52	3	41	3				
50	130	4	65	3	52	3				
60	154	5	77	4	62	4				
75	192	5	96	4	77	4				
100	249	5	124	4	99	4				
125	312	6	156	5	125	5				
150	360	6	180	5	144	5				
200	480	6	240	5	192	5				

The values on page (6) for full-load current are for motors running at speeds usual for belted motors and motors with normal torque characteristics. Motors built for especially low speeds or high torques may have higher full-load currents, and multi-speed motors will have full-load current varying with speed, in which case the nameplate current rating shall be used.

To obtain full-load currents of 208 volt and 200 volt motors, increase corresponding 230 volt motor full-load currents by 10 and 15 percent, respec-tively.

The voltages listed are rated motor voltages. Corresponding nominal system voltages are 110 to 120, 220 to 240, 440 to 480, and 550 to 600 volts.

BEARINGS

REMOVING DEFECTIVE BEARINGS

It is important to follow proper safety procedures before dismantling fan. Be sure the power is locked out.

1. Remove shaft guard and clean shaft with em-ery cloth.

2. Coat shaft with oil and spray bearing race with penetrating oil.

3. Remove belt guard, sheave and belt guard back plate.

4. Using a felt marker, mark on shaft location of bearings. Also mark location (horizontally) of bearing pillow blocks.

5. Using 2 x 4's, shim up the shaft in front of the outboard bearing and remove set screws and/ or locking collar.

6. Apply a downward pressure on the shaft using a come-along or chain to hold shaft down. Be careful not to gouge shaft.

7. Loosen bolts on inboard bearing and remove outboard bearing bolts.

8. Remove outboard bearing. This procedure should be used for removing inboard bearing also. Additional 2 x 4's will be required.

Notes:

1. When removing bearings, never beat on the shaft as this could cause the shaft to move in the impeller hub and damage the wheel coating.

2. It is important that the wheel is properly lined up. After bearings are installed and prior to locking set screws, inspect relationship of wheel and inlet cone. (See inlet cone align-ment). Rotate wheel by hand to insure wheel does not rub on inlet cone.

MOUNTING BEARINGS

Prior to mounting new bearings, it is important to inspect the shaft for wear at bearing mount-ing locations. The diameter of shaft should not be undersized more than commercial ground and polished tolerances. Excessive wear will cause the bearing race and shaft to be non-concentric result-ing in an imbal-ance problem.

1. After inspecting shaft, slide the new bearings over the shaft loosely.

2. Insert mounting bolts and secure bearing to base. (Do not tighten bolts at this point).

3. Position shaft and pillow blocks as indicated by markings and shim bearings as necessary for vertical alignment.

4. Tighten bearing's bolts. (Prior to locking bear-ing to shaft, turn impeller by hand to align bearings).

5. Bearing's set screws and/or locking collars can now be secured. Locktite should be used to insure set screws do not vibrate loose.

Notes:

1. Remove inspection door and inspect relation-ship of wheel and cone prior to tightening set screws. It is important that wheel and cone do not touch. (See inlet cone alignment). Rotate wheel by hand to insure wheel does not rub on inlet cone.

2. If bearings are equipped with locking collars, it is important to observe the following instruc-tions.

A. Slip locking collar on inner race eccentric recess and slide bearing on shaft in same arrangement as noted in removal.

B. Position bearings to marks as indicated in step 3, mounting bearings.

C. Tighten bearing bolts.

D. Rotate locking collar in direction of shaft rotation and against inner races cam until eccentrics engage.

A. Slip locking collar on inner race eccentric recess and slide bearing on shaft in same arrangement as noted in removal.

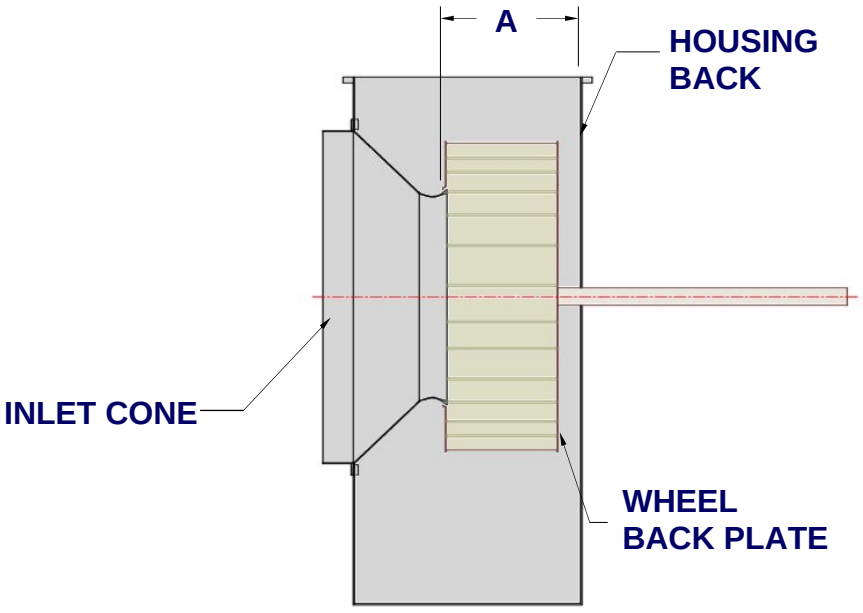
B. Position bearings to marks as indicated in step 3, mounting bearings.

C. Tighten bearing bolts.

D. Rotate locking collar in direction of shaft rotation and against inner races cam until eccentrics engage.

FAN SIZE	12	15	18	22	24	27	30	33	36	40	44	49	54	60
A	4 1/2”	5 1/2”	7”	8 1/2”	9 1/4”	10 1/8”	11 1/4”	12 1/4”	12 3/8”	13 3/8”	14 3/4”	16 1/4”	17 7/8”	21 3/4”

Dimension “A” should be measured at (4) points 90^0 apart



Motor HP	TEFC Motor Frame Size	Motor Weight
1	143T	40
1 1/2	145T	45
2	145T	45
3	182T	82
5	184T	90
7 1/2	213T	145
10	215T	160
15	254T	230
20	256T	250
25	284T	355
30	286T	390
40	324T	550
50	326T	610
60	364T	835
75	365T	920
100	405T	1260
125	444T	1515
150	445T	1785

SHOULD YOU EXPERIENCE PROBLEMS WITH YOUR MAPCO EQUIPMENT, THE FOLLOWING INFORMATION SHOULD BE UTILIZED IN DETERMING THE CAUSE AND SOLUTION TO YOUR SPECIFIC PROBLEM.

PROBLEM	POSSIBLE CAUSE
EXCESSIVE VIBRATION	Material build-up on fan im-peller Worn or corroded impeller Impeller out of balance De-lamination of balancing weight Sheaves eccentric or out of balance Bearing or drive misalign-ment Defective bearing Belts too tight Mismatched belts Motor out of balance Foundation not flat or level, weak or resonant foundation Bent shaft Impeller or sheaves loose on shaft Static pressure too low
HIGH BEAR-ING TEMPER-ATURE	Over lubrication Under lubrication Wrong lubricant Defective bearing
HIGH MOTOR TEMPERA-TURE	Check input power Check fan rotation Check for obstructions around motor shroud Check system static pres-sure
AIR FLOW TOO HIGH	Static pressure too low (less resistance to flow than ex-pected) Fan RPM higher than design Dampers not installed or need to be adjusted
AIR FLOW TOO LOW	Static pressure too high (more resistance to flow than expected) Impeller rotation wrong Fan RPM lower than de-sign Obstructions or leaks in duct-work Sharp elbows at fan inlet or outlet No straight duct prior to fan inlet Clogged filters
FAN DOES NOT OPER-ATE	Electricity is turned off or improperly wired Blown fuses Broken belts Loose sheaves Improper voltage Overload protector has bro-ken circuit
EXCESSIVE NOISE	Material build-up on fan im-peller Defective bearing RPM too high Impeller out of balance Vibrating parts not isolat-ed from building Fan operating in a stall condi-tion (DANGER) Loose mounting bolts Vibrating ductwork Belts too loose or tight Ductwork too small

WASHDOWN SCHEDULE
24 hour day

PHASE	DELIVERY GPM	FREQUENCY	DURATION (seconds)	GALLONS (per cycle)	GALLONS (per day)	HEADER SIZE
Phase IV		X / day				
Phase III		X's / day				
Phase II		X's / day				
Phase I		X's /day				

MIST ELIMINATOR (optional)

Phase I						
Phase II						

TERMINATOR EXHAUST HOOD (optional)

Hood # 1		X's/day				
Hood # 2		"				
Hood # 3		"				
Hood # 4		"				
Hood # 5		"				
Hood # 6		"				
Hood # 7		"				
Hood # 8		"				
Hood # 9		"				
Hood # 10		"				

WASHDOWN PROGRAM FORM

TIME	PHASE 3 VALVE 3	PHASE 2 VALVE 2	PHASE 1 VALVE 1	MIST ELIMINATOR OR HOOD
12:00 AM				
1:00 AM				
2:00 AM				
2:15 AM				
3:00 AM				
4:00 AM				
5:00 AM				
6:00 AM				
7:00 AM				
8:00 AM				
8:15 AM				
8:45 AM				
9:00 AM				
10:00 AM				
11:00 AM				
12:00 PM				
1:00 PM				
1:15 PM				
2:00 PM				
2:15 PM				
3:00 PM				
4:00 PM				
5:00 PM				
5:15 PM				
6:00 PM				
7:00 PM				
8:00 PM				
8:15 PM				
9:00 PM				
10:00 PM				

MULTI-PURPOSE, 4 CHANNEL
365 Day Advance Single Holiday and Seasonal Scheduling

MODELS WITH & WITHOUT ASTRONOMIC

DZS400A

NEW

APPLICATIONS

- HVAC Equipment
- Interior Lighting
- Electric Motors
- Horns, Bells
- Outdoor Lighting and Signs
- Refrigeration defrost control
  - Condensers
  - Heaters

Capable of different schedules each day of the week.

ON and OFF SET POINTS

Total # Per Week	Minimum Setting
99	1 minute

FEATURES

Astronomic (Model DZS 400A only)	1. Adjustable 10° - 60 Northern or Southern latitudes. 2. Each channel can be individually offset ±1-99 minutes from both sunset and sunrise times.
Holidays	1 to 24 individual dates
Seasons	1 to 4 with different daily schedules which can wrap around into the new year
Daylight Saving	Automatic adjustment (can be omitted)
Leap Year	Automatic compensation
Display	LCD
Manual Override	Until the next regularly scheduled ON or OFF. Automatic operation then resumes.
Signal/Pulse Duration	2 different settings per channel - each 1-99 seconds.
Clock Format	AM/PM
Power Outage Backup	Permanent schedule retention for up to 40 years
	Snap-in lithium battery maintains real time

PERMANENT SCHEDULE RETENTION WITHOUT POWER FOR UP TO 40 YEARS

Meets California Energy Commission Title 24 requirements.

SPECIFICATIONS

Power Consumption: 6 VA Max.

Contact Ratings:

Type	Voltage	Rating
General Purpose	24-277 VAC, 30 VDC	10A
Tungsten	120 VAC	360 watts
Pilot Duty	120-277 VAC	360 VA
Motor Load	120 VAC 208-240 VAC	1/4 HP 1/3 HP

Operating Temperature: -40°F to +158°F (-40°C to +70°C)

Enclosure:
See end of controls section for dimensions.
Noryl® indoor/outdoor (NEMA 3R) is standard.
For **metal indoor** (add suffix Y to catalog #).

Other Mountings:
Metal indoor/outdoor (suffix O) - Model 9000A.
Flush with lock and key (suffix FLG) – Model 9011.
Bracket for panel mounting – consult factory.

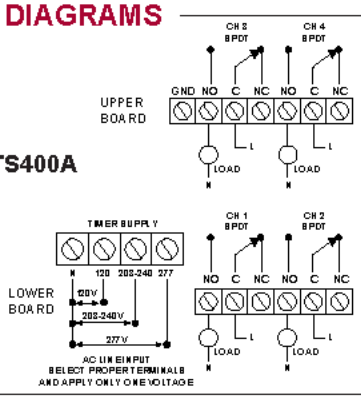
ORDERING INFORMATION

Type	Model	Clock Input - VAC 50/60 Hz	Dry Contacts (unpowered)
Astronomic and Pulse Switching Capability	DZS400A*	120 / (208 - 240) / 277	SPDT
Multi-Purpose with Pulse Switching Capability	DTS400A**	120 / (208 - 240) / 277	SPDT
	DTS400A-24	24	SPDT

* For 12VDC or 24VAC, consult factory.
** For 12VDC, consult factory.
NOTE: For latching contactors, use Model DZM200A.

WIRING DIAGRAMS

DZS/DTS400A



For 208-240V, connect one of the line wires to terminal N. Do *NOT* bring any neutral wire to this terminal.

SPECIFICATION WRITER'S GUIDE

1. Furnish and install where noted a 4 channel digital time switch.
2. Controller shall program in AM/PM format.
3. Controller shall program in one minute resolution.
4. Display shall be of LCD type.
5. Controller shall be capable of 99 set points; separate scheduling for each day of the week.
6. Controller shall have 365 day holiday capabilities with 24 single dates and 4 seasons of unlimited duration.
7. Different daily schedules shall be programmable within each season.
8. Controller shall have Daylight Saving or Standard time.
9. Controller shall have automatic Leap Year correction.
10. Schedules shall be retained for 40 years without power.
11. Controller shall have 30 day backup for real time using field replaceable 9V lithium battery.
12. Controller shall be capable of manual override ON or OFF to the next scheduled event using 1 button for each channel.
13. Unit shall have NEMA Type 3 indoor/outdoor enclosure as standard.
14. Controller shall be capable of having 2 different pulse durations 1-99 seconds, user settable and assignable to each channel.
15. Controller shall be capable of having astronomic on one (or all) channels with 1-99 minutes, plus or minus offset from Sunrise or Sunset.
16. To order specify TORK Model D _ _400A

TORK MODEL DTS400A / DZS400A
4 CHANNEL DIGITAL TIME SWITCH
INSTALLATION & OPERATION

CAPABILITIES

365 Day Advance Single Holiday and Seasonal Scheduling.

ON and OFF (signal or pulse) set points.
Combined total for all channels - 99 per week
Minimum setting - 1 minute

Capable of different schedules each day of the week.

Astronomic Option **(DZS400A only)**. For Automatic ON at sunset, OFF at sunrise of outdoor lighting.

FEATURES

Holidays	1 to 24 individual dates.
Seasons	1 to 4 with different daily schedules which wrap around into the new year.
Signal Durations	1 to 99 seconds. (2 different durations per channel)
Daylight Saving	Automatic adjustment (can be omitted).
Leap Year	Automatic compensation.
Display	LCD
Manual Override	Until the next regularly scheduled ON or OFF. Automatic operation then resumes.
Clock Format	AM/PM only (although 24HR may flash, it is not available at present).
Power Outage	Permanent schedule retention for up to 40 years. Snap-in lithium battery maintains real time.
Operating Temperature	4° to 140°F (-20° to 60° C).

TABLE OF CONTENTS

INSTRUCTIONS FOR INSTALLATION

1. Remove unit from enclosure by pushing the inside tab (located near the outside hasp) to the right. Swing unit to left and remove.
2. Five combination 1/2" and 3/4" knockouts are provided on this enclosure. Remove the 1/2" (inner) knockout by inserting a screwdriver in the slot provided and pound screwdriver handle with a hammer. Remove knock-out with pliers and smooth hole edges with file or knife if necessary. When the 3/4" outer knockout is required, place screwdriver in groove and pound screwdriver handle with hammer. Remove loose knock-out with pliers and smooth hole edges with file or knife if necessary.

Disconnect power at main panel prior to installing or servicing this time switch or the equipment connected to it.

Connect in accordance with national and local electrical codes.

Installation by a licensed electrical contractor is recommended.

3. When attaching conduit to enclosure, exercise care to align and support conduit in order to prevent unnecessary stress on enclosure.
4. Install 9V lithium battery supplied with the unit. *Note:* Unit should be connected to AC power within 24 hours of battery installation in order to prolong battery life which has 30 day cumulative backup for real time and 7-10 year shelf life. REPLACE WITH ANOTHER 9V NON-RECHARGEABLE BATTERY ONLY.
5. Reinstall unit by reversing step 1 above and connect wires according to wiring diagram on inside case label.

GROUNDING

National Electrical Code requires that grounding must be continuous and in proper electrical contact in all grounding conductors, metallic conduits and grounding terminals. When using metal conduits, install the proper size approved grounding bushings. The minimum size copper grounding conductors must be #10 AWG if the circuit breaker or fuse is 30 or 40 amp, #12AWG if 20 amps, and #14 AWG if 15 amp.

NOTE: Do not use top entry for wiring.

WE SUGGEST YOU MAKE COPIES OF THE SCHEDULE SHEETS LOCATED IN BACK OF THIS BOOKLET AND COMPLETE THEM PRIOR TO SETTING THE UNIT.

INSTRUCTIONS FOR SETTING THE UNIT

Connect unit to main power source prior to entering the settings.

First time power up - display shows 12HR

Press **ENTER**.

Note: If screen shows 24HR, press hour key so that 12H appears instead. Then press **ENTER**. This unit will *not* accept 24 hour military format although it may appear on the screen.

After you press **ENTER** unit display shows

NOTE:

1. If 24HR format is entered in error, it can only be changed by clearing all memory. See note 4 on page 13.
2. Unit will not go to run mode unless it has clock and calendar information.
3. In any of the other setting modes, if no entry is made for 5 minutes, unit will go to run mode (time and day are displayed - colons are flashing).

1.0 TO SET THE CLOCK (Time of day and day of the week.)

Press **HOUR** to advance the time in hours to desired setting. Check AM/PM.

Press **MIN** to advance the time in minutes to desired setting.

Press **DAY** key to advance to today's day.

When present hour, minute and day are shown, press **ENTER**.

1.1 TO MODIFY THE CLOCK

(If the unit was already running the program, then unit will show the day of the week, hours, minutes).

Press **MODE** key. Display shows current time and day with colon *NOT* flashing and CLK symbol at the bottom.

Use **HOUR**, **MIN**, and **DAY** key to modify or alter the information. You must press **ENTER** to make the changes effective.

2.0 TO SET DATE

If you are setting for the first time, display will show

Press **MONTH** key. Display will show 010194

Advance month to desired setting.

Press **DATE** key to advance date.

Press **YEAR** key to advance to correct year.

When desired MONTH, DAY and YEAR are on the display, press **ENTER**.

2.1 TO MODIFY OR CHANGE DATE

Press **MODE** key until display shows DATE. Use **MONTH**, **DATE** and **YEAR** key to modify MONTH, DATE, YEAR. Press **ENTER**.

3.0 DAYLIGHT SAVING TIME

This unit is already set for automatic DAYLIGHT SAVING adjustment. If this is desired, you can proceed to section 4.0 by pressing mode key.

Display will show

To eliminate daylight saving adjustment, press **ON/OFF** key.

Display should show

Press **ENTER**. Daylight saving correction is deleted or turned off.

4.0 SEASON DURATION SET

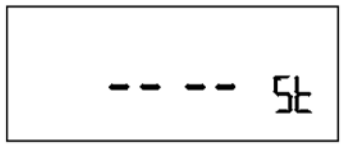
You can set up to four different seasons. If this is *NOT* needed, you can proceed to section 5.0 by pressing mode key.

Season durations are set by starting MONTH/DATE and ending MONTH/DATE:

NOTE:

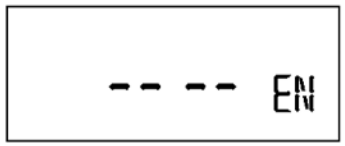
1. Each season can be set for up to 364 days.
2. Any season can cross the year boundary, i.e., season can start in the current year and end in the next year.
3. When any two or more seasons overlap, the higher numbered season has priority.

Press **MODE** key till display shows



Unit is ready to be programmed for starting MONTH and DATE for season 1.

Press **MONTH** and **DATE** keys to set MONTH and DATE for starting of season 1. Press **ENTER**. Display now shows



Use MONTH and DATE key to set ending MONTH and DATE for season 1. Press **ENTER**.

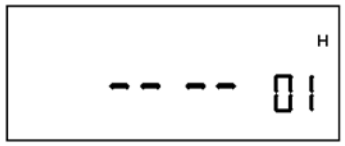
Set the start and end for other 3 seasons if desired.

To delete an entry, press **DLETE** key.

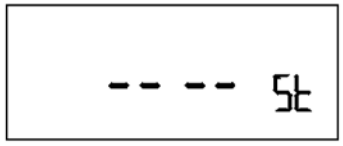
NOTE: If for any reason you set starting MONTH and DATE and forget to set ending MONTH and DATE, that season becomes invalid. Unit will erase the starting date.

5.0 SET INDIVIDUAL HOLIDAY DATES

Press **MODE** key until display shows



Press **MODE** key till display shows



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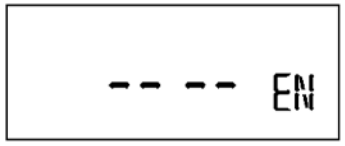

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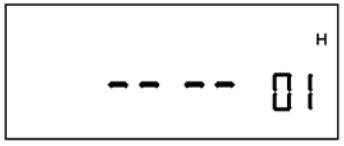
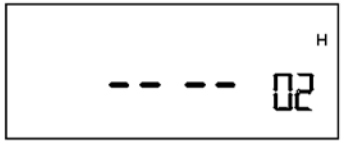
5.0 SET INDIVIDUAL HOLIDAY DATES

Press **MODE** key until display shows



NOTE:
A total of 24 individual holiday dates can be set. Each holiday is set by MONTH and DATE. The same schedule will repeat on every holiday date.

Press **MONTH** key to advance to desired month.
Press **DATE** key to advance to desired date.
Press **ENTER**. Now display shows



This means unit is ready to accept 2nd holiday date.

Use same procedure to set more holidays.

To delete a holiday date press the **DLETE** key. Press **ENTER**.

6.0 TO SET SIGNAL DURATIONS FOR EACH CHANNEL

If you do not require any signal settings proceed to section 7.0 by pressing mode key.

Press **MODE** key till display shows

This means unit is ready to accept signal duration (in SEC). for CH1, SIG1. (SIG1 or SIG2 can be set from 1 sec. to 99 sec.).

If you do not want CH1 as a signal timer, then select channel 2, 3, or 4 by pressing **SELCT** key. Or, you can set all channels for signal durations.

After selecting proper channel, press **SIG/SEC** key to set signal 1 duration to desired number of seconds. Press **ENTER**.

7.1 CHANNEL SELECTION

Press **SELCT** key to choose channel 1, 2, 3, or 4. When desired channel flashes, begin setting hours and minutes.

7.2 SETTING HOURS AND MINUTES

Press **HOUR** and **MIN** keys to desired setting.

a. If channel selected is being used for time ON or time OFF, press **ON/OFF** key to desired setting.
   or
b. If channel selected is being used as a signal timer (you must have already set the signal durations) press **SIG/SEC** key to set for signal 1 or signal 2.

7.3 SETTING DAYS, HOLIDAY, SEASONS

MO (Monday) is flashing - If Monday is desired, press **SELCT** key. If Monday is *not* desired, press **DAY** key to pass Monday and advance to Tuesday.

a. Press **SELCT** key to select the flashing day, holiday, or season.
b. Press **DAY** key to pass the flashing day and advance to other days, holiday, and seasons.

The same schedule will repeat on every holiday date.

Each season can have a different daily schedule.

NOTE: SELCT key can also be used to *delete* a day, holiday, or season *previously selected* when the aforementioned is flashing.

When you have desired time, event, steady days and season, press **ENTER**. This completes the first schedule entry.

Now display shows that SCH 02 appears on the display.

eans unit is ready to accept 2nd sch

me procedure to set more SCHEDUL
l 1.

ou are finished setting schedules for
ress **SELCT** key at the next blank s
en and CH2 will flash. You can now
schedules for channel 2, followed by
nd 4.

ASTRONOMIC SCHEDULE
DZS400A only) .

ARE SETTING MODEL DTS400A,
TION 9.0.

ess **MODE** key until display shows

ELCT key to choose channel 1, char
l 3, or channel 4.

ult, latitude north 10° will appear on the d

tude of your location can be set in this

AT key to advance to the desired
0° north or 10° to 60° south. Press **EI**
n not be used for latitudes greater tha

Now display shows