

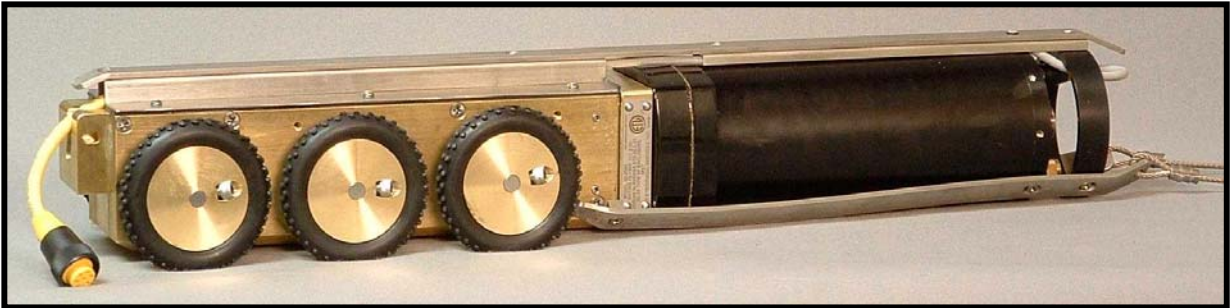


Design and Manufacture of Video Pipeline Inspection Systems
A Full Service Company
www.rstechserv.com

Mainline Tractor Transport Vehicle

Model 32-2020

INSTALLATION MANUAL



Made in the USA

IMPORTANT SAFETY NOTICE

Fire Safety Conditional Approvals

A fire safety conditional approval must be issued by an appropriate licensed electrical engineer for use of this sewer camera in areas of a sewer that have been demonstrated by testing and monitoring not to fall under the “Fire Safety Approval” requirement in Section 2540.2 of Title 8 of the California Code of Regulations. Testing and monitoring will be considered by the California Division of Occupational Safety and Health, to be sufficient for this purpose if all measurements indicate that the sewer atmosphere is below 10% of the lower explosive limit (LEL) and if the user meets all of the following additional conditions:

- (1) Before each use, inspects cable and electrical equipment for damage or wear that could compromise safety;
- (2) Test operates the sewer camera and associated electrical equipment in a dry location away from any potential exposure to hazardous conditions to determine whether the equipment functions normally and without any problems, such as sparking, loose connections, or other similar safety problems;
- (3) Tests for the existence of a hazardous atmosphere prior to opening any sewer access point using a multi-gas tester, and before energizing the equipment, conducts a test of the sewer atmosphere at the access point estimated to be closest to the end point of the camera work;
- (4) Provides continuous monitoring in the alarm mode at the access point from which the work is performed at all times while the sewer inspection camera is energized in the sewer;
- (5) De-energizes all electrical equipment and uses mechanical ventilation of a measurement exceeding 10% of the LEL is obtained;

and Discontinues use of all electrical equipment if the sewer environment cannot be maintained below 10%.

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Operator and Equipment Safety

It is important to be familiar with operations, maintenance, and safety issues when working with RST equipment.



Read the entire manual before operating the equipment.

To prevent personal injury or damage to equipment, **turn off Camera power**. When making electrical connections, width adjustments and when maintaining the tractor or camera, disconnect all power to the control station before servicing.

Inspect all transport, camera, lighting cables, and bridles before and after each use. Replace any broken, worn or frayed bridles or cables.



Always use care when near an open manhole, and when climbing in or out of a TV inspection vehicle. The tractor and camera assembly can be placed into the pipeline **without** personnel entering the manhole. Use proper lifting ropes, cranes and winches for lifting equipment in/out of pipes.

Set up

Before you can begin to televise the line, set up for the proper pipeline size. It may be necessary to set up the main line tractor one size smaller than the pipeline being inspected. For larger line sizes, the most common size change will be made by adding extensions. Set camera forks level or above flow of pipe to keep the lens out of the water. To adjust cradle, bend up at a 90-degree angle, loosen or tighten bolt and jam nut as necessary. Another method is to raise camera using balloon carriage assembly.

MAINLINE TRACTOR TIRE AND EXTENSIONS APPLICATIONS GUIDE

The following are the sizes of tire extensions offered in kit
P/N 840-10765

CAUTION



The 3-3/4-inch tractor tire extension should **NEVER** be stacked together or combined with any other size tire extension. This may cause the tractor axle to bend when being pulled backward through the pipeline.

The following applications of extensions are recommended for use with each type of RST tractor tire:

STANDARD WHEEL WITH KNOBBY TIRE: P/N 443-10603

Material: Brass hub, knobby rubber tire
Wheels per tractor: 6

STANDARD WHEEL WITH STUDDED TIRE: P/N 443-15441

Material: Brass hub, standard knobby rubber tire with steel studs
Wheels per tractor: 6

WIRE WHEEL: P/N 443-15831

Material: Stainless steel wire brushes on a steel hub
Wheels per tractor: 4

Pipe Size	Recommended Tire Extension Size
6-inch	No extension required
8-inch	Qty: 1, 1-inch extension per tire
10-inch	Qty: 1, 1-3/4-inch extension per tire
12-inch	Qty: 1, 1-inch extension per tire AND Qty: 1, 1-3/4-inch extension per tire Stacked together
Up to 16-inch	Qty: 1, 3-3/4-inch extension per tire

HIGH TRACTION CASTER WHEEL P/N 443-10190

Material: Aluminum hub, hard rubber high traction tread tire

Wheels per tractor: 6

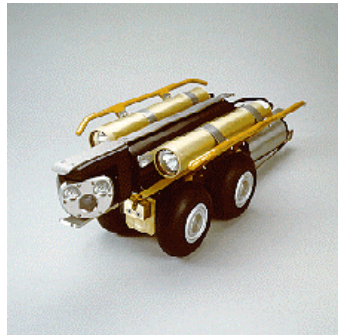
Pipe Size	Recommended Tire Extension Size
8-inch	No extension required
10-inch	Qty: 1, 1-inch extension per tire
12-inch	Qty: 1, 1-3/4-inch extension per tire
15-inch	Qty: 1, 1-inch extension per tire AND Qty: 1, 1-3/4-inch extension per tire Stacked together
24-inch	Qty: 1, 3-3/4-inch extension per tire

KNOBBY BALLOON TIRE: P/N 867-21714

Material: Aluminum hub, knobby rubber tire

Wheels per tractor: 4

Pipe Size	Recommended Tire Extension Size
12-inch	No extension required
15-inch	Qty: 1, 1-inch extension per tire
18-inch	Qty: 1, 1-3/4-inch extension per tire
20-inch	Qty: 1, 1-inch extension per tire AND Qty: 1, 1-3/4-inch extension per tire Stacked together
24-inch	Qty: 1, 3-3/4-inch extension per tire



Tractor with balloon carriage assembly P/N 866-12939

Water Resistance Interconnect Cable.

ATTACHING CAMERA to TRACTOR 6-PIN

Make sure camera and Tractor are clean before assembly.

Place camera inside tractor cradle lining up mounting holes.

Bend cradle forks in a 90-degree angle to access to mounting bolts.

Start 2 screws in front mounting holes by hand.

Start 2 screws in rear mounting holes by hand.

Tighten front and rear screws using Allen wrench. (5/32, long arm)

NOTE: Always tighten front screws first.

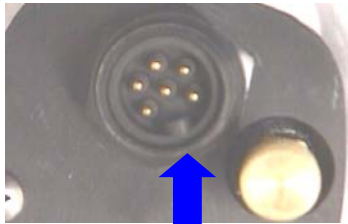
Return assembled cradle to its tractoring position.

Locate indexing notch on camera power cable and align with indexing tab on bulkhead connector.

Align connectors and carefully tighten nut while gently rocking connector to seat for watertight connection. (Ref. photo below)

DO NOT OVER TIGHTEN.

Bulkhead connector



Indexing Tab

Camera power cable



Indexing notch

Cable Grip Adjustment

Check cable grip for proper adjustment. If adjustment is needed:

Clean out cap screws on cable grip as well as cable.

Loosen four cap screws on cable grip.

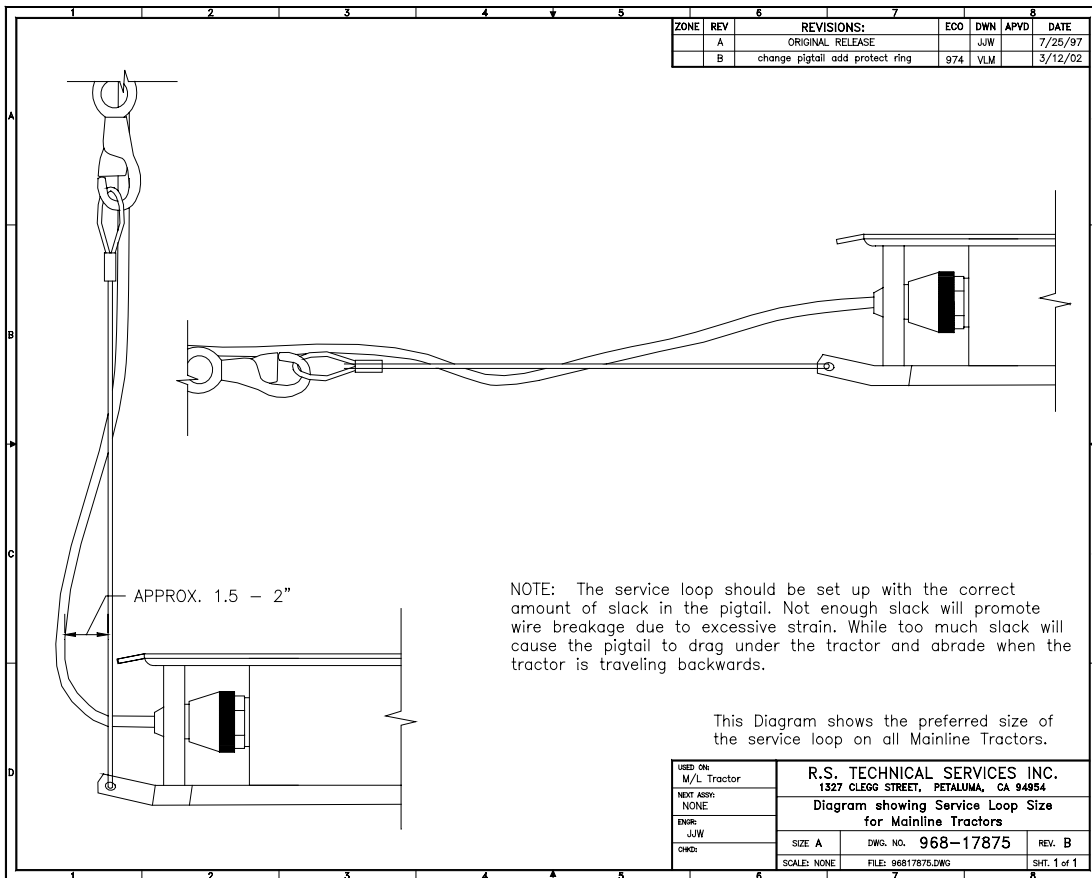
With the screws loose, it may be necessary to pop cable grip on a hard surface to separate halves from cable.

Slide cable grip to allow for proper slack. The cable grip should be adjusted to provide slack in the watertight connection, when bridle is tight. There should be enough slack to allow wire area to bend, but not enough to bend boot area when cable is raised at a 90-degree angle while loading and unloading equipment.

Retighten cap screws on cable grip. The halves should be tightened evenly to prevent binding. Always use a cross pattern when tightening cable grip.



**WARNING! IMPROPER CABLE GRIP ADJUSTMENT
CAUSES ROLLOVERS AND WATERTIGHT
CONNECTION FAILURE!**



Balloon Carriage

Installation Instructions

To install Omni III or Omni Star refer to install manual for those cameras

1. Prep tractor to install balloon carriage assembly.

Take camera off cradle and take cradle off the tractor. Take the tires off the tractor. Loosen the two flat heads phillips screws that hold the top rail on the tractor body. Pull cable out and towards rear of tractor. Reinstall top rail and screws. **(Photo 1)**

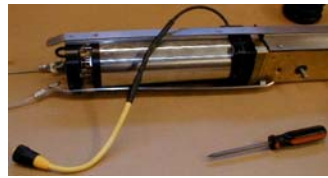


Photo 1

2. Install balloon carriage assembly to the OE II camera.

Start the four 5/16"-18x1/2" SHCS (socket head cap screw) through the holes in balloon carriage assembly channel into the camera. **(Photo 2)** Tighten all 4 5/16"-18x1/2" SHCS with an Allen wrench. Put the assembly over and onto the tractor. Start the eight 10:32x1/2" SHCS that hold the balloon carriage to the tractor body. After they are all started, tighten all eight 10:32x1/2" SHCS with a Allen wrench. **(Photo 3)**

Photo 2

Photo 3



- 2a. Install balloon carriage assembly to the OE III camera. (Use kit 840-20616)

Start the 2 5/16"-18x1/2" SHCS through the single holes in balloon carriage assembly rail into the OEIII adapter bracket. Start the 2 5/16"x1/2" SHCS through the center holes in the balloon carriage assembly rail into the bracket. **(Photo 4)** Tighten all 4 5/16"x1/2" SHCS with an Allen wrench.

Photo 4

Photo 5



3. Installing large line lights.

Loosen the Two $\frac{1}{4}$ "-20x1/2" SHCS on each light mounting bracket. Take one $\frac{1}{4}$ "-20x1/2" SHCS out of each bracket. Slide the front section of the light assembly into the mounting brackets on the balloon carriage assembly. Slide the light until it is even with the front of the camera tube. **(Photo 7)** Reinstall and tighten the $\frac{1}{4}$ "-20x1/2" SHCS into the bracket and tighten with Allen wrench. (Do not over tighten) **(Photo 8)**



Photo 7



Photo 8

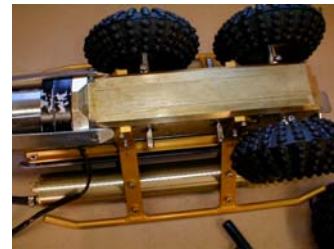
4. Attach cables together. The tractor cable connects to the light and the light cable attaches to the camera. Use cable ties and wrap up cables to keep them out of the way. **(Photo 9-10)**



Photo 9



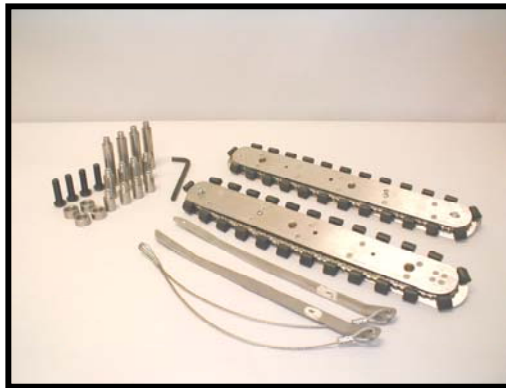
Photo 10



5. Install tires. Turn completed assembly upside down. Rotate all axles until the flats are pointed upward. Slide the tire assembly on the axles and tighten with an Allen wrench.

Tread Drive Set Up

INSTALLATION INSTRUCTIONS MAINLINE TRACTOR TRACTOR TREAD DRIVE OPTION P/N 032-02100



Required Tools:

- #2 Phillips head screw driver
- 1/8" hex key
- 3/32" hex key
- 5/16" hex key (included in the kit)

Note: Please read these instructions prior to starting the installation process. This instruction outlines the steps to configure the tractor for use in an eight-inch line. If the tractor is to be used to inspect a larger line, the skid set does not need to be changed. See the note following step 8 for instructions on selecting and using the correct tread drive assembly spacers.

1. Remove the standard skid set from the tractor using a #2 Phillips screwdriver.

Note: The screws that were removed from the rear mounting holes are shorter than the front mounting screws.

2. Install the optional tread drive skid set. Reuse the screws that were removed. Make sure to use the shorter screws to fasten the rear of the skid to the tractor motor.

Note: One end of each skid has been specially machined to provide proper clearance. The edge with the large radius must face down and toward the front. Prior to installing the second skid, make sure that there are no twists in the cable tow bridle. The skid set included with this option must be installed if the tractor is going to be used in an eight-inch line.

The special skid set will perform as well as a standard skid set when the tractor is used with wheels.

3. Place the tractor on its right side. Remove the three wheel assemblies with a 1/8" hex key. Clean any debris from the two 1/2"-13 threaded holes located in the tractor side plate. Place one of the 1/2" non-threaded spacers over each of the 1/2"-13 threaded holes.
4. Identify the left side tread drive assembly. To do this, locate the tread drive assembly that will have the black plastic rub strip facing the bottom when the tread drive assembly is mounted on the tractor body.

Note: The tractor drive assemblies are driven by the tractor's front drive axle.

5. Place the tread drive assembly on a flat surface. Make sure that the tread drive assembly drive hub is facing down. Insert a 1/2"-13 x 1.75" button head bolt into each of the 1/2" mounting holes located in the tread drive assembly. Align the two 1/2"-13 bolts over the two 1/2" spacers and align the drive hub over the tractor front drive axle. Lower the tread drives assembly into place. Tighten the 1/2"-13 bolts with the 5/16" hex key.
6. Turn the drive chain until the setscrew in the drive hub is aligned with the machined slot located on the tractor front drive axle. Tighten the drive hub set screw using the 3/32" hex key.
7. Check the drive chain for proper tension by placing the 5/16" hex key between the chain and the tread drive side plate. Perform this test at the midpoint of the side plate. Correct drive chain tension is achieved when the 5/16" hex key fits freely between the chain and the side plate. If required adjust the chain tension by turning the pan head screw located near the center of the tread drive assembly. Turn the screw clockwise to tighten the chain or counter-clockwise to loosen the chain.
8. Install the right side tread drive assembly using the procedure outlined above. The tractor is now ready for use in an 8" line.

Note: The tread drive option includes the spacers that are required when the tractor will be run in lines larger than 8". Select the appropriate axle extension for use in the line to be inspected. Select the matching threaded spacer included with the tread drive option. After removing the wheel assemblies, install the selected axle extensions on the tractor's front drive axle. After cleaning the 1/2"-13 threaded holes, install the threaded spacers into the threaded holes. Make sure the body of the threaded spacers make contact with the tractor side plate. Place the 1/2" non-threaded spacers on top of the installed threaded spacers. Install the tread drive assembly as described above.

System Power



CAUTION: NEVER HOOK UP OR DISCONNECT ANY EQUIPMENT WITH POWER TURNED ON!

The Inspection System requires a steady supply of 120VAC to operate properly. Before starting of the generator or connecting shore power, make sure that ALL equipment inside the vehicle has been turned OFF. Turn down the controls for camera power and cable reel speed. After all equipment has been checked, connect the shore power cord.

If a generator is to be used, allow the generator to warm up for a few minutes. Note: Diesel generators use a different control panel that is separate from the controller power supply. Refer to the appropriate generator operators manual for starting.

Verify that the voltage and frequency indicators on the controller power supply are in the green normal zone.



Caution: Before turning on any equipment, plug the keyboard into the data collection system. Plug the Auxiliary Control Box into the Auxiliary Control jack on the controller power supply.



Caution: If the voltage or frequency fluctuates into the red zones on the controller power supply, **DO NOT** turn on any of the equipment in the truck. Check shore power or the generator for proper operation, or have them checked by a qualified technician.



Caution: Route cords away from traffic or wet areas to avoid tripping on power cords.

Lowering Equipment into Pipeline

Locate the back of the truck so that the cable reel lines up in the direction of the pipeline to be inspected. Allow room to work around the opening while carrying the equipment.

Follow cable grip, bridle, and watertight connection instructions. Re-check the pipeline size and extension adjustments. Do not let cable “loop” at the location where it enters pipeline. Use guide poles with hook to keep the tractor stable as it enters pipeline.



Caution: Maintain control of equipment while lowering and lifting from manhole.

Most equipment damage occurs when camera is lowered into hole.

Pull camera/tractor far enough into pipeline to clear the bridle or cable grip. Set the cable guide. Use double roller and/or single rollers, for protecting the cable and allowing it to slide down the hole without drag on the line. Use enough poles to clear top of the manhole by 2 feet.



Caution: Watch out for people, power lines and traffic when handling the downhole pole

Put cable reel into “freewheel” and reel off enough cable so camera and tractor can be lowered into the bottom of the manhole. Place lowering rope ring under the top front runner or front of camera. Support weight of tractor and camera with the cable in one hand and rope in the other.

NOTE: RST skycrane can be used in place of the cable and rope method.

Slowly lower the front of camera into manhole to clear manhole ring. Lower tractor and camera to the bottom of manhole facing camera in the direction of the pipeline to be inspected. When tractor and camera are resting on bottom of manhole, release the rope ring and remove it from the manhole.

Check all camera and tractor functions again before proceeding. Move tractor forward so the rear of the tractor and the cable connections are fully inside the pipe. The use of guide poles with a hook will help to keep the tractor stable as it enters the pipeline.

Install the down hole pole, double roller, and top manhole roller. The use of double roller and/or single roller is for protecting the cable and allowing it to slide down the hole without drag on the line. Remove any slack from the cable and reset the footage counter. It is best to do this by hand or with cable reel set to low speed.

The tractor has an automatic “disengage” feature that allows for the freewheeling retrieval. To disengage the tractor, reverse its direction momentarily. This will disengage the drive mechanism and allow the tractor to be pulled out of the pipeline in “freewheel” by the cable reel.

Retrieval of the Equipment

Ending the Run

Make sure tractor is in "free wheel".
Use low speed while retrieving tractor.
Use care when removing camera from line.
Back tractor out of pipe into manhole so that front of tractor is clear of pipe.
Remove rollers and poles to make room to lift tractor and camera from manhole.
Lower rope with ring and catch the end of camera at the same place used to lower tractor and camera.
Lift tractor and camera assembly from manhole using the rope and cable.

NOTE: RST skycrane can be used in place of the cable and rope retrieval method.

Keep the camera clear of any ladders or drop lines.
When tractor and camera are out of hole:
Turn down light power on camera,
Turn off camera power,
Wash unit over hole,
Wipe down and store the cable, camera, and tractor.

Maintenance

Each time the tractor is removed from the pipeline wash the entire assembly.

Inspect camera cradle and mounting hardware.

Inspect individual axles and tires for excessive wear or damage. Replace if necessary.

Inspect the power cable, bridle and watertight connector for damage.

Inspect bridle, skids, top rails, and mounting hardware.

Tractor Rebuild



Inspect bridle, bulkhead, and camera power cable, upper skid rails and screws.

Inspect all screws and cradle mount.

To inspect gear housing: remove screws holding the top skid and grease cover.

Inspect the grease for discoloration or a metallic look. Inspect for visible wear on gears

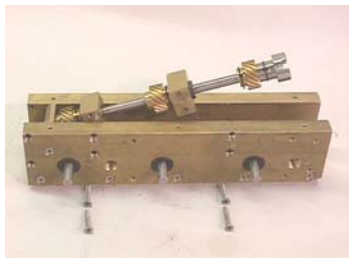


Move axles in all direction to check for excessive wear in the bushing.

Inspect axle seal for leakage.

Remove 4 set screws (2 each side)

Separate tractor motor assembly (TMA) from brass body.



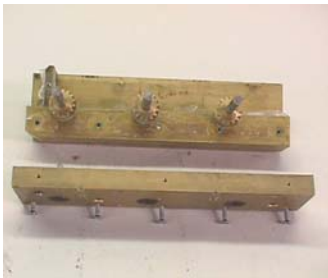
Rebuild brass and/or send in TMA.

Remove the 4 screws and pull out main drive axle.

Repair and replace gears on main drive axle.

Pull clip and push out pin. Slide gear off.





Remove the rest of the screws and pry off side plate.

Remove axle, repair or replace.

Pry out leaking seals with screwdriver.

Clean all surfaces and reapply silicon.

Replace all screws (hand tighten)

Keep flats on axles facing the same direction.

Slide in main drive axle.

Spin axle assembly by hand to check if free.

Apply silicon RTV to brass body and attach TMA. Retighten the 4 set screws.

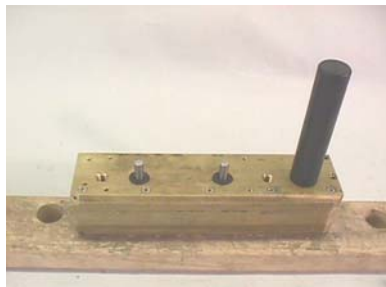
Plug in pigtail and test unit.

Replace seals (keep seals flat). Install flush with brass body.

Fill body with grease and replace all covers and skids with screws.

Reassemble wheel assemblies, camera cradle, and install camera.

Do final test run on unit before inserting into a line.



MAINLINE TRACTOR PARTS & ACCESSORIES

TRACTOR MOTOR PARTS

805-17785	COMPLETE MOTOR ASSY, TYPE "A" VERSION
635-17887	GEAR MOTOR ONLY ,DC, MAINLINE TRACTOR
867-20813	ASSY, CLUTCH, REVERSING, M/L TRACTOR
867-14724	ASSY, CLUTCH, M/L TRACTOR
861-10884	ASSY, PCB, TRACTOR DUAL TONE DECODER/CONTROLLER
861-21321	ASSY, PCB, TRACTOR, RELAY/FILTER, 'A' MOTOR (LOCKED ROTOR)
861-14085	ASSY, PCB, TRACTOR POWER SUPPLY, M/L TRACTOR
802-31468	COMPLETE TRACTOR BACK ASSY, INCLUDING CIRCUIT BOARDS
802-31479	COMPLETE TRACTOR BACK ASSY, LESS CIRCUIT BOARDS
	INCLUDES: 6 PIN PREWIRED BULKHEAD CONN., TNC BHC, & AIR PRESSURE FITTING
453-13930-21	TRACTOR BACK PLATE, ANODIZED BARE
806-31465	BULKHEAD CONNECTOR, 6 PIN, PREWIRED FOR TRACTOR ONLY
560-15227	PROTECTOR, BULKHEAD(SCREW ON STYLE)
555-11154	CONN,TNC,BULKHEAD, 1/2" MODIFIED(FOR TRACTOR BACK)
602-10512	FITTING, AIR PRESSURE, 1/4" MALE (ON TRACTOR BACK)
632-31479	INSULATOR, SHIELDED, DTMF /RELAY PCB, MLT

AXLES/GEAR ASSEMBLIES AND PARTS

840-21285	COMPLETE REBUILD KIT, TRACTOR BODY
805-19449	ASSY, AXLE, WHEEL DRIVE
805-20421	ASSY, AXLE, MAIN DRIVE W/3 GEARS
407-20405	AXLE, MAIN DRIVE, MLT, (AXLE ONLY)
407-20407	AXLE, WHEEL DRIVE, MLT (AXLE ONLY)
840-20808	KIT, GEAR, DOUBLE HUB, (INCLUDES PIN & CLIP)
840-20809	KIT, GEAR, SINGLE HUB, M/L TRACTOR
441-20406	GEAR, DOUBLE HUB ONLY, PIN/CLIP STYLE (GEAR ONLY)
441-20409	GEAR, SINGLE HUB, PIN/CLIP STYLE (GEAR ONLY)
439-10719	SEAL, TRACTOR AXLE
405-10658	BUSHING, TRACTOR AXLE, DELRIN
	THESE BUSHINGS MUST BE REAMED WITH A .379 INCH
	REAMER AFTER BEING INSTALLED. ORDER RST PART #633-15420
633-15420	REAMER, .379" FOR TRACTOR AXLE BUSHING
453-18594	BLOCK, FRONT & CRADLE MOUNT
606-13439	BLOCK, DRIVE SHAFT BEARING

HARDWARE

840-11296	KIT, HARDWARE, M/L TRACTOR
840-30611	KIT, HARDWARE, TOP SKID AND CHANNEL, M/L TRACTOR
453-14164	COVER, GEAR, MAINLINE TRACTOR
439-10778	GASKET, TRACTOR TOP
630-12577	GREASE, SEMI-FLUID UTILITY TYPE 3 6 OZ. JAR
630-15592	ADH,RTV,CLEAR,2.8 OZ TUBE

451-15092	GREASE DAM
840-20821	KIT, REPAIR, GEAR COVER STANDOFF ML TRACTOR
400-10656	PIN, MOTOR MOUNTING

TRACTOR CRADLE ASSEMBLIES

800-17767	CAMERA CRADLE ASSY. MAINLINE/OEI/OEII
800-21075	CAMERA CRADLE ASSY. OEIII
800-15305	RACK, STORAGE, TRACTOR

TRACTOR CRADLE PARTS

305-15315	BOLT, PIVOT, TRACTOR CRADLE
840-18252	KIT, UPGRADE, SS CRADLE FORK (2 FORKS)
450-17766	SKID RUNNER, TRACTOR CRADLE, 1/2"X1/2" DELRIN
453-14686-21	CENTER CRADLE PLATE
453-14802-21	RIGHT SIDE CRADLE PLATE
453-10965-21	LEFT SIDE CRADLE PLATE

TRACTOR RAILS & SKIDS

451-19072	TOP MOTOR RAIL
451-14451	TOP BODY RAIL
807-21024	TRACTOR BOTTOM SKID SET WITH BRIDLE (REPLACES 450-13985)
450-19093	SKID, TRACTOR TOP (REPLACES 450-10842)
410-19071-21	PROTECTOR RING (TO PROTECT BULKHEAD CONNECTOR)
NEW!	PROTECTION FROM BULKHEAD DAMAGE DUE TO IMPACTS!!!
840-21023	TNC PROTECTOR RING KIT FOR MAINLINE TRACTOR
INCLUDES:	410-19071 RING PROTECTOR
	451-19072 TOP MOTOR RAIL
	450-19093 TOP TRACTOR SKID
	807-21024 BOTTOM SKID SET
	301-12707 8-32x3/8" FLT. HD SCREW (2)
	301-12359 8-32X1/2" FLT. HD SCREW (1)

3- PIN MAINLINE TRACTOR

3-PIN PUSH ON PIGTAIL TRACTOR MOTOR PARTS

861-10884	ASSY, PCB, TRACTOR DUAL TONE DECODER/CONTROLLER
861-21321	ASSY, PCB, TRACTOR, RELAY/FILTER, 'A' MOTOR (LOCKED ROTOR)
861-14085	ASSY, PCB, TRACTOR POWER SUPPLY, M/L TRACTOR
802-17886	COMPLETE TRACTOR BACK ASSY, INCLUDING CIRCUIT BOARDS
802-11352	COMPLETE TRACTOR BACK ASSY, LESS CIRCUIT BOARDS
INCLUDES:	3 PIN PREWIRED BULKHEAD CONN., TNC BHC, & AIR PRESSURE FITTING
453-13930-21	TRACTOR BACK PLATE, ANODIZED BARE
806-21194	BULKHEAD CONNECTOR, 3 PIN, PREWIRED FOR TRACTOR ONLY
560-15227	PROTECTOR, BULKHEAD(SCREW ON STYLE)