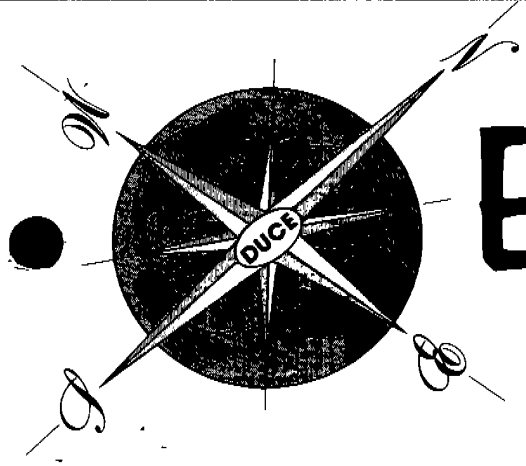


Exsaco Corporation

MFG: TIVOLI
NAME: ORBITOR
TYPE: NON-KIDDIE

P.O. Drawer 328 • One North Santa Fe Street • Alvarado, Texas 76009
Telephone: (817) 783-2265 • Telex: 730300

January 22, 1992

Dear Inspector,

During our attendance at the 1992 A.R.E.A. Seminar, it was brought to our attention that the lack of communication has placed a strain on the amusement industry for many years.

In an attempt to lessen the communication gap which presently exists, Exsaco Corporation is furnishing you with copies of past service and safety bulletins. In addition, we will attempt to provide you with any future written information that will assist you in your job.

Exsaco is striving to remedy the communication problem that now exists in our industry. If we can be of assistance to you in the future, please do not hesitate to contact our office at 1-800-545-0667.

Sincerely,

EXSACO CORPORATION

Jeff Miller
Sales

JM/cjg

Enclosures

P.S. Complete Operator's Manuals are available upon request for a nominal fee.

Tivoli Enterprises Ltd

Howfield Lane, Chartham, Canterbury, Kent CT4 7HG England.
Telephone: 0227 731156

NON-DESTRUCTIVE TESTING AND SAFETY MODIFICATIONS POLICY FOR TIVOLI, LTD.

All Tivoli manufactured amusement rides are designed to the highest degree of safety and quality. Indepth engineering and design analysis has been incorporated into all equipment produced. Tivoli, Ltd., therefore, requires no scheduled testing by non-destructive means for the engineered life of the components, unless listed below and issued to customer in the form of a service or safety bulletin, or indicated in Operation Manual.

It should also be understood that this policy is based on the operator/owner exercising proper maintenance and care procedures of all components according to the manufacturers' specifications, along with routine visual inspection of all structural components for any unusual circumstances. Any unusual circumstance must be reported to the manufacturer immediately.

In the event that a fault or potential safety problem is discovered through our own testing or field experience requiring an annual test or modification, information concerning these tests or modifications will be made available immediately to the owner of the equipment.

Below are listed all current safety service bulletins or equipment modification bulletins.

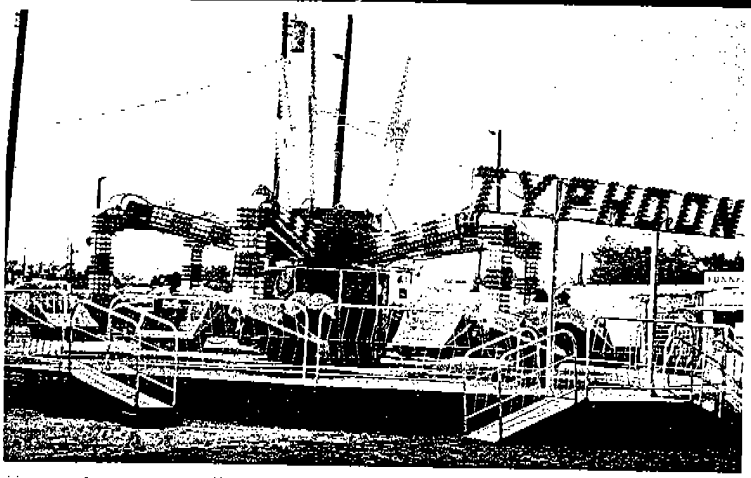
BULLETIN NUMBER	RIDE	CONCERNING	EFFECTIVE DATE
00103	*Force 10*	*Safety system*	*July 8, 1988*
00000	*Force 10*	*Boom Crack*	
00108	*Force 10*	*Lap Bar Spring*	*Jan 16, 1989*

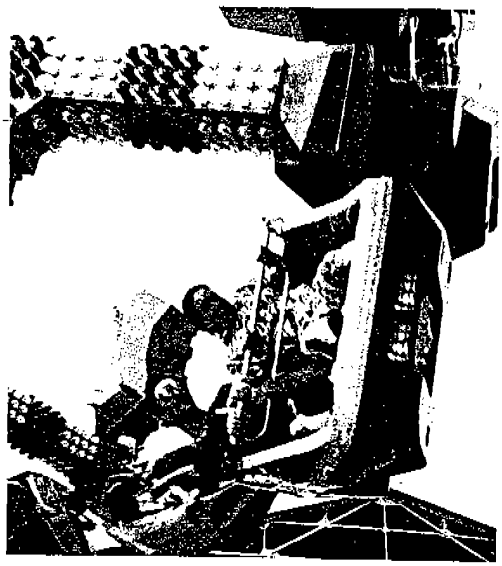
Tivoli Enterprises, Ltd.

Exsaco Corporation

P.O. Drawer 328
One North Santa Fe
Alvarado, Texas 76009
(817) 783-2265 TLX 730300
FAX (817) 783-3358

ORBITER





Look To Exsaco for
New and Innovative Rides
"The Reliable Source"

Worldwide Supplier to the Amusement Industry

Exs[illegible] Corporation

ORBITER SPECIFICATIONS

SEATING CAPACITY

Number of Cars 18
Maximum Number of Passengers Per Car 2
Maximum Total Number of Passengers 36
Loading .... All Cars Simultaneously
Capacity ..... 1200 Per Hour

PERFORMANCE

Direction of Travel ..... Clockwise
Ride Speed (maximum) Center Column ..... 20 rpm
Ride Speed (maximum) Seat Clusters ..... 28 rpm
Ride Duration (recommended) ..... 1 min.
Drive ..... Electro-Hydraulic

POWER REQUIREMENTS

Total ..... 85 kw
Motor ..... 60 kw
Lights ..... 25 kw
Minimum/Maximum line voltage 208/220
Motor Type ... 220 volt, 3 phase, 60 Hz
Horsepower Rating 60
Lighting ..... Turbolites

TRAILER

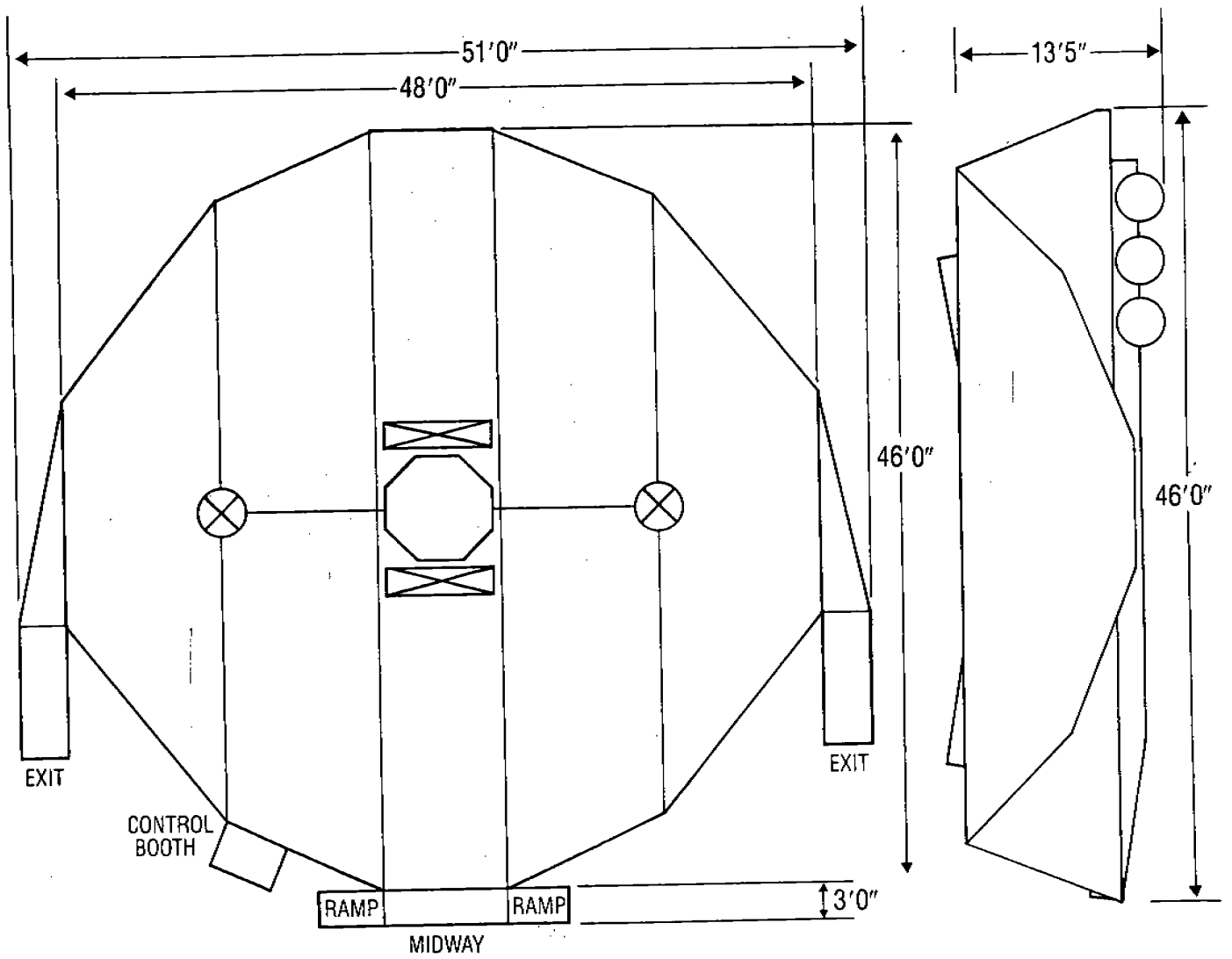
Height ..... 13 ft. 5 in.
Width ..... 8.6 ft.
Length ..... 46 ft.
Total Weight .... Approx. 68,000 lb.

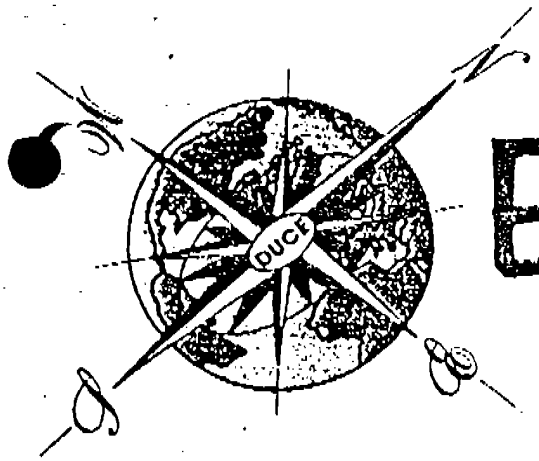
OPERATING DIAMETER

Diameter ..... 48 ft.
Height ..... 24 ft.

These specifications subject to change without notice.

Tivoli Enterprises Ltd





Exsaco Corporation

P.O. Drawer 328 • One North Santa Fe Street • Alvarado, Texas 76009
Telephone: (817) 783-2265 • Telex: 730300

January 9, 1992

To Whom It May Concern:

The use of a washer on the car attachment pins of the Orbitor (a.k.a. Typhoon, Preditor) to prevent the wear of the car attachment base metal is permitted as long as the washer is 5mm (.196 inches) or less in thickness. A washer with this thickness does not hinder the purpose of the tapered pin.

EXSACO CORPORATION

Buck A. Pate

Buck Pate

ORBITOR. (TIVOLLI/EXASCO.)

Sweeps and Cars are held in place by threaded Taper Pins.*

*THREADED TAPER PINS ARE NOT BOLTS.

THE THREADS ARE ONLY FOR INSTALLING AND REMOVING PINS OUT OF THEIR TAPER.

PINS SHOULD ONLY BE RUN DOWN UNTILL THE HEADS ARE FLUSH WITH THE BASE METAL.

DO NOT TORQUE.

The pins holding the sweeps in place are held by anut that is welded to the bottom plate on the center. These nuts are welded on the front three sides only. These welds tend to crack if overtightened.

A modification to the lap bar catch has been made and consists of a plate fixed across the top of the moving latch to prevent inadvertant operation.

AS OF THIS TIME THIS IS NOT A MANDATORY MODIFICATION.

Tivoli Enterprises Ltd

Howfield Lane, Chartham, Canterbury, Kent CT4 7HG England.
Telephone: 0227 731156

ORBITER OPERATION DESCRIPTIONS

The Orbiter amusement ride is hydraulically driven, electrically controlled. The ride is driven at 20 rpm by a hydraulic motor, having fluid supplied by a fixed displacement hydraulic pump. The center hub then lifts approximately four feet during operation as it rotates. Located at the end of each of the six (6) sweeps are pivoting turret (rotating) arms. These arms have three (3) vehicles located at the bottom end of the arms in the stopped position, they are 90° to platform for loading, and during operation they will pivot to approximately 75° while vehicles rotate at a speed of 26 rpm at full cycle. Vehicle seat rotation is achieved through a closed loop hydraulic system which operates through three (3) pumps located in center hub. These pumps are driven through a ring gear fixed to the center column of the ride. As speed of ride increases, the pumps are driven at a higher speed. Thus, proportionately increasing speed of rotating vehicles. This strictly controls the speed of the vehicles and will always be proportional to center rotation speed. Control of the Orbiter is achieved through a series of control relays. This system controls the safety of the ride by preventing each action (valve shift, pump start, etc) unless previous actions are in proper order. Duration of ride cycle is governed by a timer on the control panel which can be regulated by the operator.

OPERATION OF ORBITER AMUSEMENT RIDE

I. Ride Controls

The Orbiter Amusement Ride is controlled via a control console located in the control booth. The following controls are located on this panel:

1. Pump Start and Stop Buttons - These buttons control the main hydraulic pump electric motor. It is only necessary to start the pump at the beginning of the operating day. The pump should be left on until the ride is closed.
2. Ride Timer - This timer should be adjusted to the desired ride time. Suggested time is 60 seconds. Please note that the timer starts when the fast speed button is pushed and the time expires when the ride begins to lower and decrease in speed.

3. Slow Speed Button and Indicator Light - When green light is lit, ride will operate in slow speed, by depressing the button.
4. Fast Speed Button and Indicator Light - When green light is illuminated, fast speed button can be depressed starting automatic ride cycle.
5. Brake Button - This button activates disc brake to allow the ride to slow to a stop more quickly (during high traffic times) than normal hydraulic braking. Brake button should not be pressed before all hanging turret arms are in complete down position.
6. Light Switch - This switch turns on all lighting for the ride.
7. Light Switch (Optional) - For additional lighting if applicable.
8. Emergency Stop - This button is to be used only if an emergency arises that ride must be stopped during mid cycle. Please note that when this button is used, ride will stop in raised position. This is a protective device used in the case that there might be an obstruction on the platform. After the problem has been corrected, the ride must be reset.
9. Reset Button - This button is used to reset the emergency system if used. This is done by first removing key from key switch and resetting. When key switch is turned back on, ride will lower to loading position.
10. Key Switch - This key switch is designed to keep an unauthorized operator from starting the ride. Ride will not operate until the key is inserted, pushed in and turned on.
11. Power On Indicator - This light indicates that main power switch is on and current is to control panel.
12. Overload Indicator - This light indicates an overload in the motor circuit. When the light is on, motor will not operate until overloads are reset. Before resetting and restarting pump motor, investigate the source of the problem.
13. Arms Out/In Switch - This switch is used to control the extension of the turret arms. When the switch is turned to the "in position", arm will tilt out only as far as centrifugal force will allow. In the "out position", arm will be tilted out further by the hydraulic cylinders.

ORBITER OPERATIONAL PROCEDURES

I. Personnel Requirements

The Orbiter Amusement Ride requires a minimum of two (2) personnel to operate and monitor the ride during operation. One (1) operator must be at controls at all times with the controls situated so that he/she has viewing access of the ride as well as the second operator. The second operator must be located at an entrance and has the duties of controlling the entrance, exit, assisting patrons, and monitoring ride. Extra personnel would be required during high traffic times.

II. Passenger Restrictions

The Orbiter is an amusement ride designed to accept 36 patrons, two (2) patrons per vehicle. This number should not be exceeded for any reason. Due to the design of the vehicle, there is a hump in the center of the seat bottom to separate the two (2) patrons. Do not allow a person to sit on this hump. It could cause injury. All patrons should be notified of the following rules of operation. The Orbiter restriction sign should be posted so that it is easily read by all patrons. It should include the following:

1. No riders under 7 years of age unless accompanied by an adult.
2. No riders under 48 inches tall.
3. No food or drink allowed on ride.
4. Remove all loose articles before riding.
5. Anyone under medical care with back and/or neck trouble should not ride.
6. Pregnant women are not allowed on ride.
7. Only two (2) passengers per vehicle.

It is the responsibility of the operator to evict any rider acting in an unsafe manner. This equipment is a high speed, thrill ride. Riders will experience in excess of 2 G's during the operation of the ride.

III. Ride Cycle

When operating Orbiter amusement ride for patrons, the operator must see that the following steps are followed before, during, and after each ride cycle:

1. Allow a maximum of 36 patrons (2 persons per seat) to enter ride.
2. Check all seats to assure passengers are seated and lap bars are closed and latched.
3. Check to make certain all entrance and exit gates, chains are closed and all non-riding patrons are behind the fence. **No persons are allowed on platform during operation.**

4. Start ride in slow speed first. During one revolution, check all passengers to see if they are properly seated and lap bars are latched.
5. Start ride in fast speed.
6. After ride cycle is over and ride is down and rotating less than one (1) rpm, apply brake and wait until ride has come to a complete stop.
7. After ride cycle is over and ride has come to a complete stop, assist passengers in exiting the ride. Only when passengers have exited, allow new patrons to enter ride.

OPERATIONAL SAFETY CHECKS & INSPECTIONS

This section deals with visual inspections and safety checks of the Orbiter Amusement Ride. They are designed to assist the operator in the control of the operation of the ride. The inspections and checks should be accomplished by a qualified technician capable of understanding the functions of the components. This equipment has been designed and built to handle normal wear and tear of every day operation. It is always necessary to inspect all components and structures on a regular basis and to note or investigate any irregular conditions. It is also necessary to consult owners manual for additional maintenance and inspection procedures. In the event of any abnormal condition that is capable of causing a future failure of any component, if found it should be reported to necessary personnel and if necessary the factory should be consulted.

DAILY INSPECTION OF ORBITER BEFORE OPERATING RIDE WITH PATRONS

1. Inspect all blocking and level of main frame and platforms. Repair, reassemble, or re-level any loose blocking if necessary.
2. Check all fencing for security. Check condition of gates or chains.
3. Inspect platform for obstructions, loose floor panels, and/or tripping hazards.
4. Inspect seat lap bars and latch for proper operation.
5. Inspect vehicle attachment pins. These pins must be down flush with car attachment frame. It is not necessary to torque.
6. Check all wiring on sweeps and center. Repair any loose or hanging wires.
7. Test operation of ground fault detectors.
8. Operate ride, check for any unusual noises or actions (investigate, if necessary).
9. Test emergency system.
10. Report any problem or concerns to proper personnel.

All of the above checks should be completed along with normal daily maintenance as outlined in the operator's manual.

BI-WEEKLY OR PRE-OPENING INSPECTIONS

Note: Please consult Maintenance Manual or factory before making any adjustments.

A. All daily checks.
B. Check extension of center lift hydraulic cylinders in automatic sequence. Cylinder should not top out or bottom out during operation.
C. Check condition of main center column key and bronze slides clearance between slides and key should not exceed .125" (3mm).
D. Check operation of lift and drive valves. They should shift smoothly, not with a sudden jerk. Adjustments could be made through a choke block located between pilot and main valve.
E. Check RPM of ride - 20 RPM; Center - 26 RPM turrets.
F. Check hydraulic fluid levels. Reservoir should be completely full. If it is below sight glass, fill immediately.
G. Check operation of disc brakes. Replace pad if worn below 1/8".
H. Check extent of tilt of arms. Should not exceed approximately 75°. Adjust via relief valve.
I. Check operation of cooling fans and oil filters. If bypass indicator is red on filter, change immediately.
J. Inspect electrical panel. Assure all connections are tight and relays are functioning properly and all indicator lamps are working.
K. Inspect incoming supply wiring. All connections should be tight. (5 wires - 3 phase, neutral, ground)
L. Check to see if proper lubrication procedures were followed as outlined in manual.
M. Inspect all hydraulic lines for leaks. Repair if necessary.

EMERGENCY OR POWER FAILURE PROCEDURES

In case of an emergency or power failure, the Orbiter amusement ride is designed to come to a self-braking stop in the raised position. This is to prevent any additional problem caused by obstructions on the platform. When the ride comes to a complete stop, the condition causing the emergency stop or power outage must be investigated. If for any reason, the ride cannot be restarted, it will be necessary to use a ladder to unload patrons. (It is necessary to restart pumps and controls in order to lower ride.)

The ride seats will be approximately five feet clearance above floor.

Please report to proper authority anytime the emergency system is used. The ride should not be operated again until the condition causing the emergency stop is investigated.

PASSENGER RESTRAINT SYSTEM

Each vehicle is equipped with a stainless steel lap bar. This bar locks by the insertion of a plunger rod in socket attached to vehicle. The plunger actuator handle must be protected by a stainless steel guard (see service bulletin) to prevent accidental unlocking of bar. All spring handles and plungers must be operating properly at all times.

RIDE NAME: ORBITER
OTHER NAMES: TYPHOON PREDITOR

Manufacturer:
Tivoli Enterprises Ltd.
Howfield Lane
Chartham NR, Canterbury, Kent
CT4 7HG England

U.S. Representative:
Exsaco Corporation
One North Santa Fe Street
P.O. Drawer 328
Alvarado, Texas 76009 USA

Date of Inception and Completion of First Unit: 1977
Number of Rides Operating in USA: 23
Number of Rides Operating Worldwide: 36

OPERATING SPECIFICATIONS
DIMENSIONS (APPROXIMATELY)

Static: (No Clearance)
- Height 10'
- Width 51'0"
- Depth 49'0"

Dynamic:
- Height 26'
- Width 51'0"
- Depth 19'0"

Total Weight Static: 69,000 Pounds Approximately
Ride Speed: 20 RPM Center 26 RPM Vehicles
Passenger Capacity: 36 Adults or 36 Children
Number of Vehicles: 18
Estimated Capacity/Hour: 1,000

OPERATING RESTRICTIONS

Passenger Height Restriction: 48"
Passenger Age Restriction Unless Accompanied by Adult: 7 Years
Recommended Ride Duration: 1.5 Minutes
Passenger Load Balancing Requirements: Yes
Maximum Wind Speed for Operation: N/A
Maximum/Minimum Temperature for Operation: 32° F

ELECTRICAL REQUIREMENTS

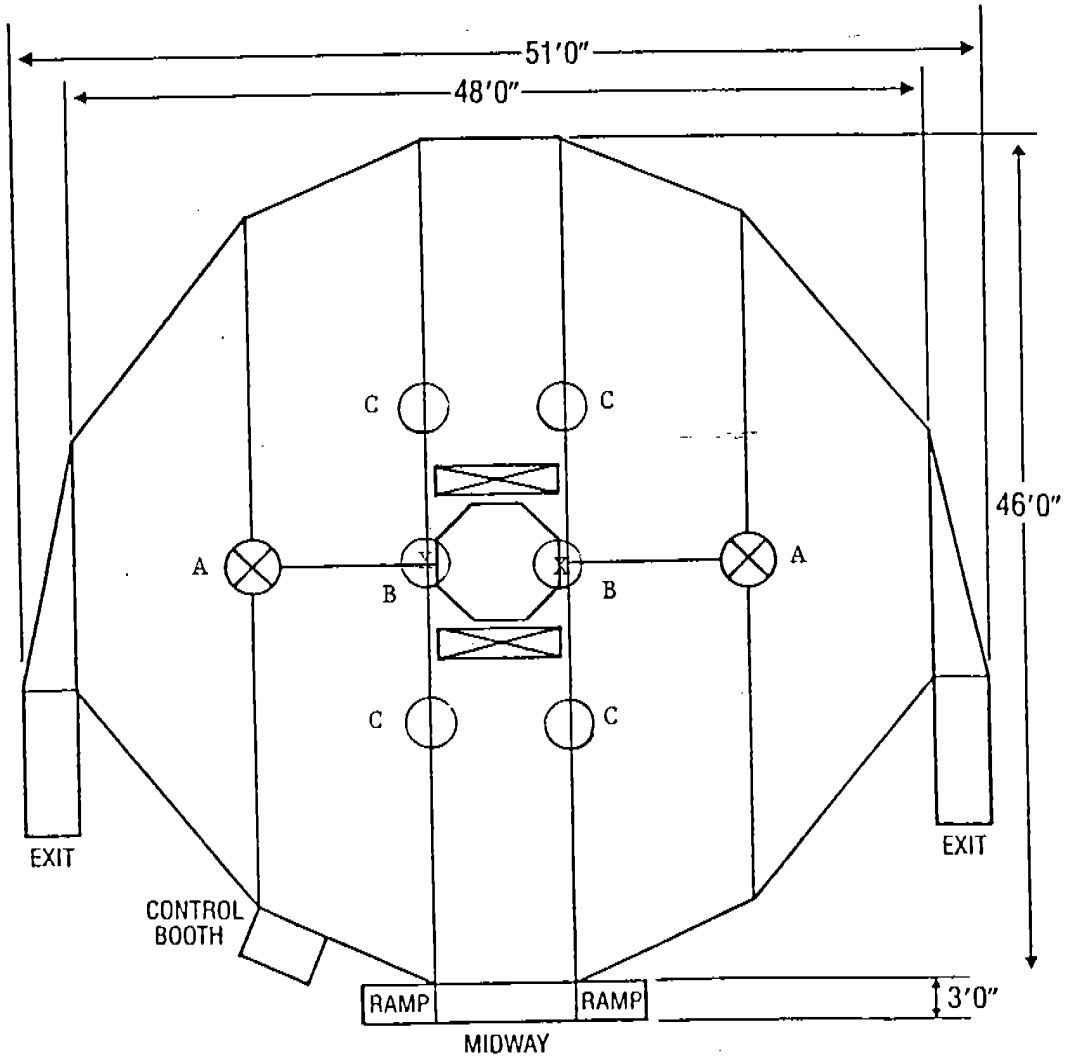
Voltage: 230 maximum 208 minimum
Type: 3 phase, 60 cycle, N.Grnd.
Maximum Power: 85 kw 250 amps
Maximum Lighting Power: 25 kw 75 amps

TRAILER INFORMATION

Trailer Length:	46 ft. 0 in.
Height:	13 ft. 5 in.
Width:	8 ft. 6 in.

Total Weight (Approximately): 25,000 lbs. king pin
45,000 on three (3) axles

STATIC AND DYNAMIC LOADS



A 8,000 LBS MAX
B 24,000 LBS MAX
C 12,000 LBS MAX

Tivoli Enterprises Ltd

Howfield Lane, Chartham, Canterbury, Kent CT4 7HG England.
Telephone: 0227 731156

NUMBER T0190

DATE February 5, 1990

SERVICE BULLETIN

RIDE Orbiter SERIAL NUMBER All

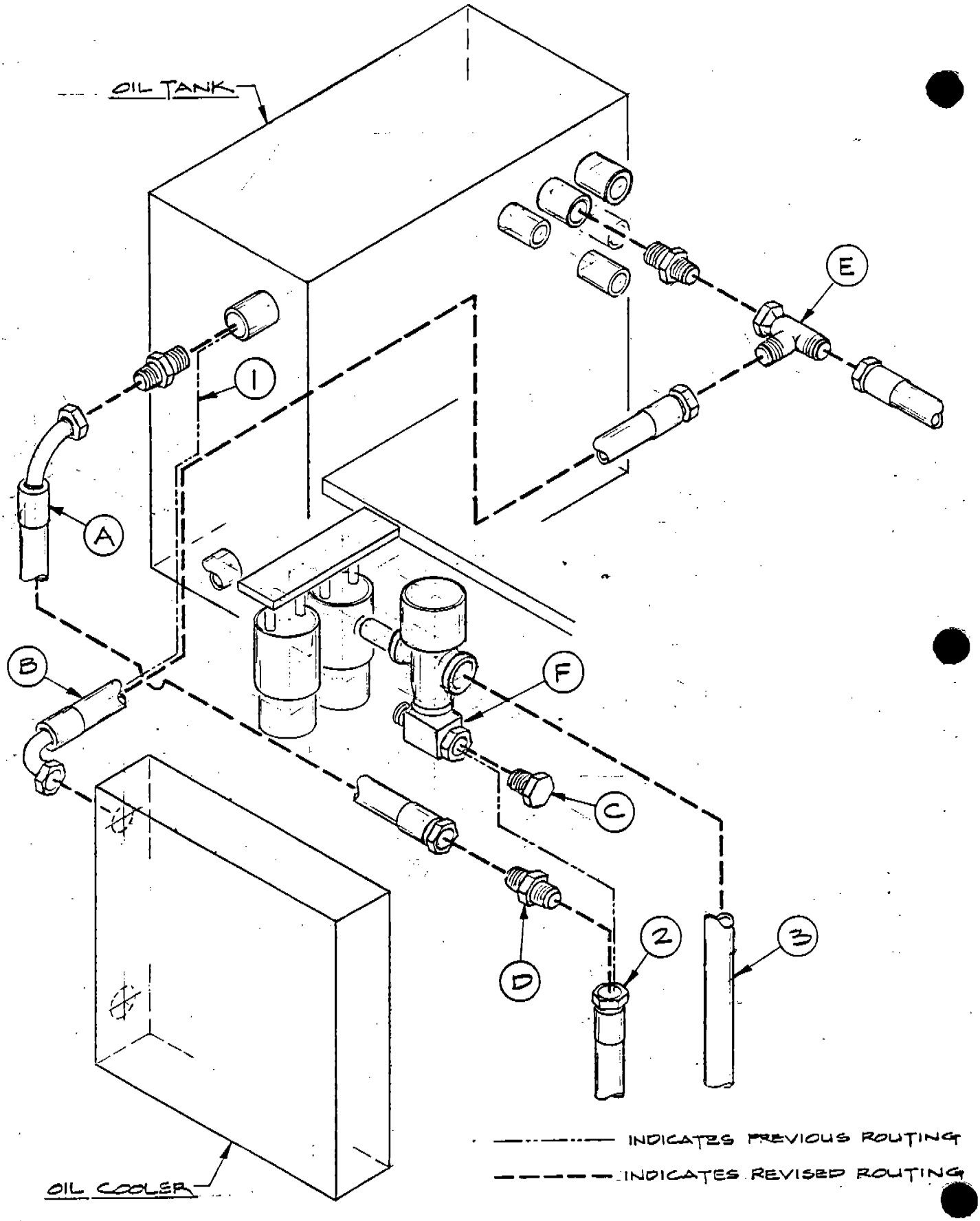
SUBJECT Staffa B10 Motors

Tivoli Enterprises, Ltd. has been made aware of a problem with the Staffa B10 motors which drive the turrets, where shaft seals have been failing excessively quick. After analyzing and running extensive tests, it has been determined that the oil cooler was creating a back pressure through the drain system in excess of 250 psi. In order to prevent future seal problems, Tivoli Enterprises, Ltd. is offering a hose kit that will reroute the case drain lines from passing through the oil cooler. This kit is available through Exsaco Corporation, One North Santa Fe Street, P.O. Drawer 328, Alvarado, Texas 76009 (817) 783-2265, free of charge, and will only be shipped to customers whose ride is experiencing this problem. Attached are the instructions for the modifications.

To reroute existing hose system (see Figure 1);

1) Remove existing Hose 1 (described by dash dot dot line). Discard.
2) Install "T" fitting (supplied) as described in Figure 1, Part E.
3) Install new Hose B from top of oil cooler to "T" fitting E.
4) Remove Hose 2 from "T" fitting F and plug "T" fitting with plug (C) supplied.
5) Install union D into Hose 2.
6) Attach new Hose A to union D and fit to top of tank port.
7) Attach Hose 2 to supplied bracket.

If you should have any questions or need further assistance, please contact Exsaco Corporation One North Santa Fe Street, P.O. Drawer 328, Alvarado, Texas 76009 (817-783-2265).


OIL TANK
E
1
A
B
F
C
D
2
3
OIL COOLER
INDICATES PREVIOUS ROUTING
INDICATES REVISED ROUTING

NON-DESTRUCTIVE TESTING AND SAFETY MODIFICATIONS POLICY FOR TIVOLI, LTD.

All Tivoli manufactured amusement rides are designed to the highest degree of safety and quality. Indepth engineering and design analysis has been incorporated into all equipment produced. Tivoli, Ltd., therefore, requires no scheduled testing by non-destructive means for the engineered life of the components, unless listed below and issued to customer in the form of a service or safety bulletin, or indicated in Operation Manual.

It should also be understood that this policy is based on the operator/owner exercising proper maintenance and care procedures of all components according to the manufacturers' specifications, along with routine visual inspection of all structural components for any unusual circumstances. Any unusual circumstance must be reported to the manufacturer immediately.

In the event that a fault or potential safety problem is discovered through our own testing or field experience requiring an annual test or modification, information concerning these tests or modifications will be made available immediately to the owner of the equipment.

Below are listed all current safety service bulletins or equipment modification bulletins.

BULLETIN NUMBER	RIDE	CONCERNING	EFFECTIVE DATE
00102	*Orbiter*	*Lap Bar*	*April 24, 1987*

Tivoli Enterprises, Ltd.

Tivoli Enterprises Ltd

Howfield Lane, Chartham, Canterbury, Kent CT4 7HG England.
Telephone: 0227 731156

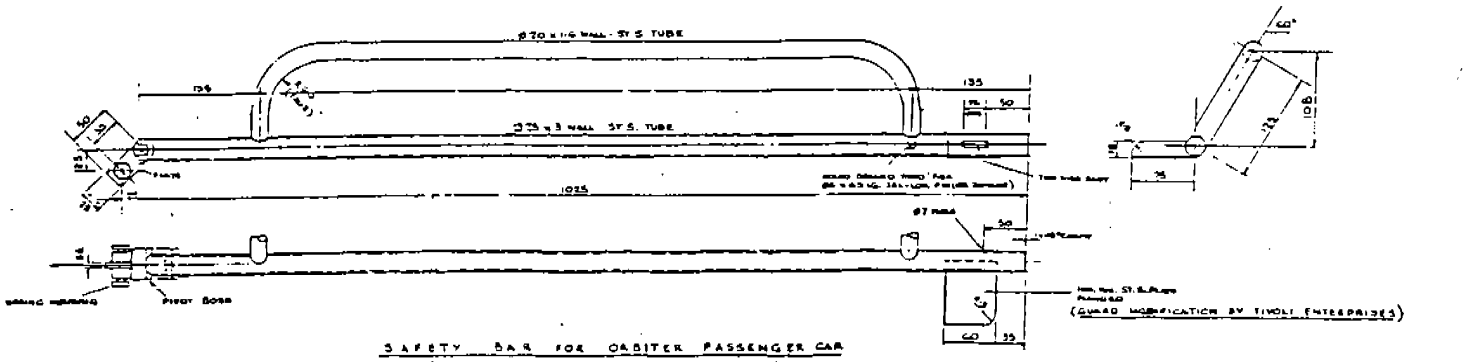
SERVICE BULLETIN

RIDE: Orbiter **DATE:** 4-24-87

SUBJECT: Lap bar release handle cover **BULLETIN NUMBER:** 00102

****

In order to prevent accidental release of lap bar Tivoli recommends the addition of a cover plate to be installed on lap bar as described below. The cover plates are available at no charge from Exsaco Corporation.



SAFETY BAR FOR ORBITER PASSENGER CAR
(WELDED STAINLESS STEEL CONSTRUCTION)

DRG. NO. 0050/87 — TIVOLI ENTERPRISES

Tivoli Enterprises Ltd

Howfield Lane, Chartham, Canterbury, Kent CT4 7HG England.
Telephone: 0227 731156

SAFETY BULLETIN

RIDE: ORBITER DATE: DECEMBER 10, 1990

SUBJECT: CAR ATTACHMENT PINS BULLETIN NUMBER: 00120

****

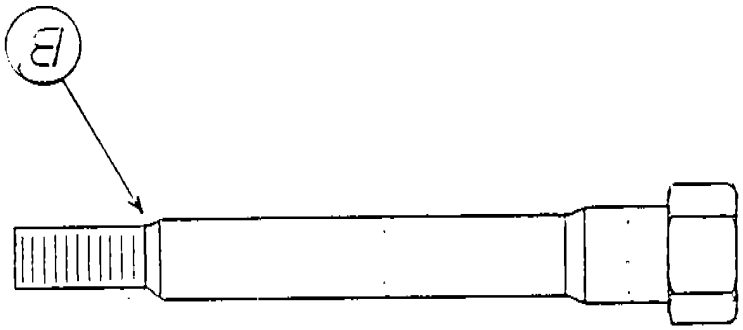
Through routine inspection of the Orbiter Amusement Ride seat attachment pins, (refer to Point A) cracks were detected in the area where the threaded portion meets the pin shaft (refer to Point B). It is recommended by Tivoli Enterprises that these seat attachment pins be inspected by an approved non-destructive testing (NDT) process to determine condition of pins. If cracks are detected, these pins should be replaced immediately. This inspection should be done immediately and then on an annual basis.

After investigation, Tivoli has determined that cracking of pins is due to excessive tightening when vehicle is being attached to sweep. As stated in the manual, these pins should not be tightened in excess of 70 foot pounds. The ride is supplied with an electrical impact wrench which is to be used only to speed the operation of installing and removing these pins. If abused, excessive tightening could damage pins. Use impact wrench to bring pins down until it meets the base metal only.

If it is in owner's or inspector's opinion that use of this impact wrench is being abused by the operator, it is recommended by Tivoli that the electric wrench be replaced with a 3/4" drive ratchet hand wrench.

If there are any further questions, please contact Exsaco Corporation at 817-783-2265.

Tivoli Enterprises, Ltd.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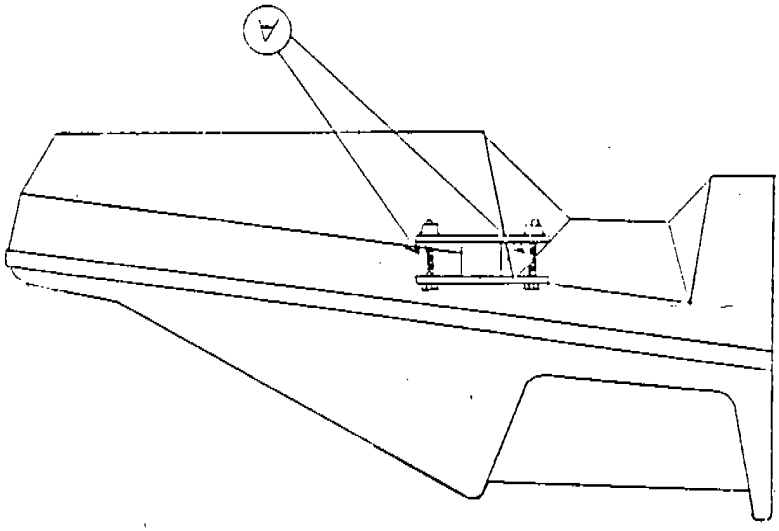
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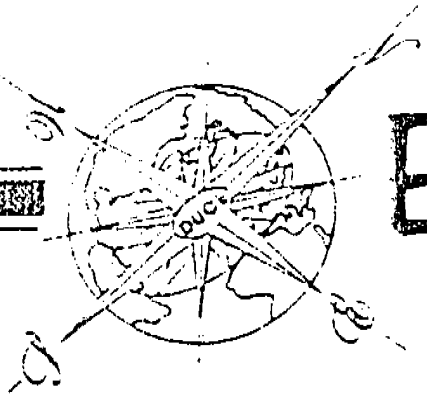

Exsaco Corporation

ORBITER

AMUSEMENT RIDE

"OPERATIONAL MANUAL"

P.O. Box 028 One North Santa Fe Street Alvarado, Texas 76009
Telephone (817)783-2265 Fax (817) 783-3053

Tivoli Enterprises Ltd

Howfield Lane, Chartham, Canterbury, Kent CT4 7HG England.
Telephone: 0227 731156

This Manual has been prepared by TIVOLI LTD., for use by Owners and Operators of the ORBITOR AMUSEMENT RIDE. It is our recommendation that this Manual be read and understood so the Orbiter ride can be operated economically and safely.

The information in this Manual is to be used in guiding the Operator in daily inspection and maintenance procedures. Since it is the intent of TIVOLI LTD. to always upgrade and improve their products, some specifications may be different from previous equipment. If this situation arises, please contact Manufacturer for additional information and/or update.

I N D E X

****

SET UP

INSTRUCTIONS

****

ORBITER

SET UP INSTRUCTIONS

STEP 1:

Locate trailer on as level an area as possible. Front of trailer should be located towards midway. *(see clearance specifications on page 2)

STEP 2:

While tractor is still attached to trailer, install power leads and control leads into provided comloc and control connections. Connections are located under center of trailer. Extend control box 115V outlet to area where control cabin will be located.

STEP 3:

Connect control cable to control console located in control box on goose neck of trailer. With power on, activate hydraulic pumps with switch on console (control lock out key is not necessary at this point). Check motor rotation.

STEP 4:

Swing out leveling jack controls located at center of curb side of trailer. Remove lock wedges from goose neck, hinge point (two (2) places). Remove security chains for leveling jacks from trailer frame.

STEP 5:

Unpin and swing out main outrigger located center sides of trailer. This must be done before raising or lowering trailer.

STEP 6:

Lower leveling jacks until they are approximately one (1) foot above ground; slide one (1) 4' x 8' sheet of 3/4" plywood under each jack pad. Lower jacks until major portion of trailer weight is taken up by jacks.

STEP 7:

Disconnect locking mechanism from tractors fifth wheel. Drive tractor forward until king pin is clear of fifth wheel lock mechanism, but weight of goose neck is still on fifth wheel.

STEP 8:

Using forward jacks only, raise front of trailer until goose neck becomes straight with trailer and starts to lift off tractor. Remove tractor at this time and lower front of trailer until approximately level with back of trailer.

STEP 9:

Using rear jacks only, raise trailer until majority of weight is off tires. Remove pin on rear axle locking device. Using large block of wood, knock latch open (both sides of trailer).

STEP 10:

Disengage air lines from rear axle frame.

STEP 11:

Raise rear of trailer until trailer lifts off and clears axle frame locking pins. Pull rear axle frame out from under trailer. Make sure there is clearance of rear bumper. Remove axle frame completely.

STEP 12:

Lower rear of tailer until approximately level with front. Using both jack controls; simultaneously, lower both jacks being careful to keep both leveling cylinders on each jack even; so as not to tilt trailer. Lower both sides of trailer until trailer frame is approximately six (6) inches from ground.

*IMPORTANT: When using leveling jacks, note that each jack front and back has two hydraulic cylinders; one curb side and one drivers side of trailer with separate controls. Special attention should be given to see that both of these cylinders work evenly so as not to excessively tilt trailer. It is possible to tilt trailer over if jacks are misused. It is recommended by the Manufacturer to practice operating jacks before operating with trailer weight.

STEP 13:

With trailer six (6) inches above ground, block and level trailer in six (6) places (see diagram on page 3) using preferrably a 3' x 12' plank(s). It is recommended that at least a three (3) foot square on the initial layer is needed and a two (2) foot square for each additional layer until it is necessary to use two (2) foot square plywood shims to bring to proper level.

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IMPORTANT

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BEFORE GOING TO STEP 18 ********** READ THIS CAREFULLY

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Under no circumstances should any person be underneath the platforms when they are under the support of the winch cable. It is necessary to attach a rope to platform and pull platforms out from a safe distance outside the ride perimeter. Failure to abide by this notification could cause severe injury.

STEP 14:

After trailer is level, block solidly outside end of outrigger (one each side) (see step 13 block instructions). Swing out secondary platform support from main outrigger and block solidly. This is to be done on both sides of trailer. Turn off main pump.

STEP 15:

Unplug control electrical cable from control box. Lay out far enough from trailer to clear platforms and in location of control cabin. Control cabin can be located at any position around ride except trailer ends.

STEP 16:

Remove exit platforms racked on rear sides of trailer and locate outside limits of outriggers. Remove fix in provided platform inserts on goose neck of trailer.

STEP 17:

Unpin hanging portin of ride platform by sliding up and turning "u" pins located inside each end of platform (two per platform). Tie 3/4" rope to center bottom portion of hanging platform; rope must be at least thirty (30) feet long. Extend rope out until it clears both primary and secondary outriggers.

STEP 18:

Attach winch control to winch and attach battery cable leads to lugs on side of ride hub and connect clamps to good well charged 12 volt battery with units supplied with 24 volt power supply plug wire into converter box.

STEP 19:

From top center of ride, inspect cable winch for proper roll-up. Check cable for attachment to platforms and ride. Inspect winch cable for any defects (flattening, breaks, etc. - see supplement) and replace if necessary.

STEP 20:

With winch control operate winch and bring cable in until taut. Unbolt platform lock brackets with electric wrench supplied with ride on side "A".

STEP 21:

With at least 3 men pulling on platform rope described in Step 16, pull out platform while operator on top center of ride simultaneously lets out winch with winch control.

STEP 22:

When platform rollers start to roll on outrigger freely without assistance of pull ropes, have persons holding rope let go and allow winch to let platform lower until completely down.

STEP 23:

Release tension on cable. Remove platform pulley and shaft, and store. Rewind cable on winch, making sure cable rolls up evenly and smoothly on winch drum.

STEP 24:

With winch control, wind platform, lowering cable until it is taut in respect to platform 'B'.

STEP 25:

For platform 'B' lowering, follow Steps 18 through 21.

STEP 26:

Using electric impact wrench, extend platform leveling jacks through using not in access holes on platform edge (see diagram page 3 for location). Use 1' x 1' x 3/4" plywood blocking under each platform jack.

STEP 27:

Unpin and unfold front entrance platform. Using fence located in control cabin, stall in provided slots and block platform jacks and sloped entrance ramps until firm.

STEP 28:

Unscrew lock down wing nut holding control cabin to trailer (located inside cabin). Using provided handles on cabin, lift and pull cabin out of cabin support platform. Roll cabin to desired location around edge of platform.

STEP 29:

Remove cabin support platform from stored place. Install in location of control cabin using fence mounting holes. Block and level.

STEP 30:

Roll control cabin onto support platform with front pointing towards ride. Install electrical control cable on control console through access hole under cabin.

STEP 31:

Unrack and install fence in provided mounting holes around platform.

STEP 32:

Unrack and move to outside edge of platform, four seats which are to the immediate right and left of hanging turret arms.

STEP 33:

Making sure that threaded pins stored in holes on sweeps at center hub are removed and laying on top center platform. Unpin racking boards on turret car attachment frames. Swing out and pin large sweeps using impact wrench provided.

*IMPORTANT: Threaded taper pins are not bolts. Threads are used only for installing and removing pins out of their taper. Pins should only be run down until the heads are flush with base metal. Do not torque over 70 pounds.

STEP 34:

With two persons holding seat, fix three seats per turret arm. Install seats in male/female frame at bottom of turret arms, using threaded taper pins. Insert pins start threads by hand; then run pins in while person lifts slightly on outside of seat. This requires the use of the impact wrench. (Please read important information in previous step).

STEP 35:

After all seats are installed, plug in car light. Install exit platforms, finish installing fence and remove all racking from ride platform. Check all pins, blocking, and make sure all racking is stored.

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ORBITER

MECHANICAL

AND

STRUCTUAL

INSPECTIONS

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********** IMPORTANT **********

Whenever working under center of Orbiter, keep center in down position. Remove scenery panels to gain easy access to all parts of center. If it becomes necessary to lift center to do maintenance or repair of ride, a steel prop capable of holding entire weight of center (excess 15 tons) should be installed.

NEVER UNDER ANY CIRCUMSTANCES: allow a person under center of column when center is in upper position.

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ORBITER MECHANICAL AND STRUCTUAL INSPECTIONS

Daily visual inspection of the Orbiter Ride is a necessary part of normal maintenance operations. It is recommended by the manufacturer that ride is always monitored for unusual sound or actions, and that they be investigated and problems determined and rectified. This practice is important to keep the small problems (oil leaks, loose wire, loose bolts, etc) from becoming a major problem. Below is a list of some of the most important areas of the Orbiter that must be inspected on a daily basis, before ride is put into operation. It is essential that all portions of ride undergo a daily inspection:

TRAILER AND PLATFORM BLOCKING:

Check all blocking under ride; if sinking, broke or loose, repair or re-block immediately. If ride is unlevel or improperly blocked, stresses that are not usually apparent can cause structual problems on ride. Please check Step 2 of set-up section for proper blocking instructions.

SEAT LATCHES:

Check condition and operation of all seat lap bar latches before starting daily operation. Check lock plunger for easy movement in lap bar tube; make sure release handle is tight and operable. Check lap bar hinge bolt and all mounting bolts; inspect spring condition. If any part is found to be defective, replace immediately.

SEAT TURRET ATTACHMENT PINS:

Inspect both pins on each seat; be sure that each is threaded down completely. (Please note that these threaded pins are not intended to be tightened, they are only to threaded down to where the head of the pin is flush with base metal). These pins are tapered; the threads are used only for installing and releasing from taper fit and are not designed to be used as a bolt.

TURRET ARM PIVOT SHAFT:

These pins located on top of turret arm are to be inspected daily for locking plate security and excessive shaft or bushing wear. Locking plates are designed to keep shaft from moving either in or out in respect to bushings and can be turned over to use other side in case of plate wear. Plates also keep shaft from turning on metal mounting plate. Pivot shafts should be removed and inspected after every 2000 hours of operation. If they show any signs of shaft wear they should be replaced immediately. If shafts are in good visual condition, they should also be internally inspected by some accepted means of NDT (non-destructive testing). Bushings should be inspected for excessive wear and should be replaced if diameter wear exceeds .025 inches or cracks appear on any part of bushing.

SWEEP HINGE LOCK PINS:

Sweep lock pins, two (2) per sweep must be checked daily to assure that they are threaded completely down so head of pin is flush with base metal. These pins work on the same principal as do the seat pin explained above and should be treated in the same way.

CENTER COLUMN KEY:

Inspect condition of key or center column daily for proper lubrication and any sign of wear or improper fit with keyway bronze slides. If keyway is damaged, replace immediately and inspect bronze slides for excessive wear (see keyway slides). It is necessary that lubrication pots be filled at all times for proper key lubrications.

KEYWAY SLIDES:

The center column key prevents center column from turning when ride is in operation. Bronze slides are installed for a bearing surface during raising and lowering of center. Inspect the slides daily for proper lubrication and fit. Wear between slides and key should not exceed .020 inches. If this is noted, remove slide housing via two (2) bolts on side of center column support and replace slides.

HYDRAULIC SYSTEM

SEQUENCE OF EVENTS AND ACTIONS

After main hydraulic motors are turned on and system is allows to warm up (usually about 10 minutes), the following events in sequence happen during one ride operation.

NO. 1

Slow speed button is depressed on control console. This activates valve 'N' which allows flow to motor 'A' causing ride to rotate at slow speed. At this time pump 'G' (arm and car system) providing fluid flow to top section of ride, allows motors 'A' to act as pumps. Motors 'A' are driven by internal ring gear, rotation of ride causes ring gear to turn motors 'A' feeding to motors 'B' located on sweep hanging arms, enabling car turrets to rotate. Please note that with this design, car turret speed is a direct relation to main ride rotation speed. Slow speed is not connected to ride duration timer and is intended to be used to make sure all patrons are seated and lap bar latched before main ride starts up.

NO. 2

After slow speed button is depressed indicator light will turn off and indicator light for fast speed will illuminate. Ride cannot be started in fast speed. Slow speed must be activated prior to fast speed.

NO. 3

Fast speed button is depressed. This causes slow speed valve 'N' to close and valves 'P' and 'Q' to open along with arm and car system valve 'F'. Immediately lift cylinders, begin to raise ride and speed of ride increases. This in turn causes arm and car system pumps 'A' to increase fluid flow to car turret motors 'B', increasing rotation speed of cars. Valve 'F'(arm and car system) opens allowing fluid to be delivered to arm tilt out cylinder 'E'. As ride speed increases and center lift cylinders 'C' reach their top limit, arm tilt cylinders extend arms to near horizontal position. Ride arrives at operating speed when main ride rotates at 18 to 20 rpm and car turrets rotate at 23 to 26 rpm.

NO. 4

Ride will operate at this speed until set ride time expires. At this point, valve 'P' and 'Q'; arm and car system valve 'F'; close. Ride starts to lower and rotation speed reduces through brake relief valve L-1 bringing ride to a down and stopped position. Valve 'F' (car and arm system) closes, allowing tilt out cylinders to retreat by means of reduced centrifugal force and gravity.

NO. 5

When ride is rotating less than 2 rpm and all turret arms are in completely down position; if necessary, ride can be stopped with the depressing of the brake button on the control console. This releases fluid pressure from brake calipers, stopping and holding ride in position until slow speed button is depressed.

OPERATION AND MAINTENANCE

"ORBITER"

HYDRAULIC SYSTEM

The Orbiter hydraulic system is designed to give many years of trouble free service. Each Orbiter is fitted with double capacity oil reservoir, double capacity twin oil coolers, double filteration with four (4) filters on pressure side of four (4) hydraulic pumps. The following will deal with each part specifically and outline any adjustments or maintenance required. (see the accompanying hydraulic schematic)

ROTATION AND CENTER LIFT SYSTEM

LTR. A

Main drive motor: Staffa B 80 S. direct drive pinion to ring gear.

LTR. B

Brake caliper: hydraulically operated with mechanical adjustment for tension. Two per ride. This brake system is designed for slow speed braking only. When ride is operating at less than 2 rpm, brake can be applied by depression of brake button on control console.

LTR. C

Center lift hydraulic cylinders: 3-1/2" rams with 4' stroke, fitted with counterbalance and flow control valve.

LTR. D

Counterbalance and flow control valve: to control speed of decent in case of hose breakage.

LTR. E

Electric motor: 50 hp, 220 volt, 3 phase, 60 hz, used to drive hydraulic pumps.

LTR. F

Double capacity oil cooler.

GENERAL HYDRAULIC TROUBLE SHOOTING

TROUBLE	TO DETERMINE CAUSE AND CORRECTIONS
Leveling jacks do not operate	Check first to see if main electric motor is operating. If not, check incoming power supply, main power switch, and ground fault interrupter. If ground fault is tripped, cause of short must be determined before electric motor can be re-started. If motor is operating, check rotation. If motor is operating properly and jacks still do not operate, hydraulic pump pressure should be checked. Check relief valve located next to jack accuator handle. Clean if necessary.
PLATFORM WINCH DOES NOT OPERATE	CHECK SUPPLEMENT
Slow rotation will not operate	Initial checks should be made of power supply and proper motor rotation. If all is correct, check pressure at gauge provided on top inside right corner of valve block. When motor is operating pressure should read continuously 1500 psi. This can be adjusted by means of relief valve located in the middle back side (hydraulic tank) of valve block. If pressure is appropriate, test hydraulic system by manually operating slow speed valve mounted on top right side of valve block. This can be done by inserting small dowl pin in end of valve electrical coil. Push pin until ride starts to rotate. If rotation occurs, problem is electrical. Consult electrical section for information. If ride still does not operate, remove valve, clean and inspect for damage. IMPORTANT: always clean hydraulic equipment with gasoline. After valve has been check for proper operation and ride still does not work, investigate operation of check valve 'S' located on front side, middle of valve block.

Fast rotation and lift does not operate	Check pressure gauge provided at top left corner of valve block. Pressure should be from 1800 psi to 2200 psi when ride rotates. If not, within these limits, adjustment can be made through relief valve located on bottom back side of valve block. If still not operable, manually test both lift valves (located bottom right side of valve block), and fast rotate valve (located top left side of valve block) by inserting and pushing small dowl pin in coil end of electrical system (review electrical section). If one valve does not work properly, remove one operational valve, clean and inspect. Please note that speed and lift directional valves have pilot control valves, which work off pilot pressure of 1500 psi, which is provided through a slow speed pump circuit. This pressure must be available for valve to work properly. This is adjusted via relief valve 'K' on middle back of valve block.
Arms will not tilt out completely	Check pressure gauge located at relief valve above hydraulic pumps on left side of electric motor, pressure can be adjusted via relief valve to between 650 psi to 800 psi. If pressure is correct, check directional valves located in top center section fo rotating hub. If my manual operation, arms tilt out, the problem will most probably be electrical.
Car turrets will not rotate	Fluid is supplied to car turret system through same relief valve as tilt out cylinders. Check for proper pressure. If pressure is correct, condition of valve 'D' is in top portion of center hub. If only one car turret is not operating, check condition of check valves on valve block for those particular sweeps.
Car turrets jump or vibrate	Check condition of center gear ring in center hub. It is necessary to remove one hydraulic motor to inspect gear teeth. Check oil supply to top center hub. Check electrical.
One car turret vibrates when rotating	Inspect slew ring and ring gear for lack of lubrication.

ORBITER

ELECTRICAL INSPECTION AND MAINTENANCE

It is recommended by TIVOLI that a daily inspection of electrical system and wiring be done to insure continuous trouble free operation. Below is a list containing information on frequency of maintenance, inspecting, and any possible adjustment procedures.

TIVOLI requires that all electrical work be done by experienced trained technicians with the ability to understand the function and care of the components.

GROUND FAULT DETECTORS:

The Orbiter is fitted with four ground fault detectors. Their function is to sense and shut down a circuit instantly if there is any type of short to ground. This equipment is very sensitive and can trip if there is too much moisture around a component. (I.E. water in light socket) Before re-setting, investigate circuit completely for any abnormalities. The circuits protected by ground fault are motor circuit 1GFD, control circuit 2GFD, car lighting 4GFD, and general lighting 3GFD. Please consult wiring diagrams for location in circuit. It is important to test ground fault detectors weekly via test button on individual components. They can be reset via reset button located on front of main control box.

CONTROL TRANSFORMERS:

The control circuit is powered through a supply transformer with a variable primary of 230v, 220v, 208v, 60cy, single phase and a variable secondary of 100v, 120v, 130v, 60cy single phase. This is provided to maintain proper voltage to control circuit. Voltage is to be maintained as close to 110 volts as possible. By changing taps, voltage can be properly set with any incoming line voltage. It is important to check this with every installation.

INDICATOR LAMPS:

All indicator lamps should be checked periodically to prevent any mis-readings if a bulb is burned out.

WYE DELTA TIMER:

This timer is used to delay full power start-up of main electrical motor to prevent surge on incoming power supply. This timer is set at approximately 5 to 6 seconds.

SOLENOID VALVES:

All hydraulic valves are fitted with epoxy sealed coils located on the pilot valves. These coils should be inspected weekly to insure that they are tight (via knurled nut at end) and plug is secure via retaining screw.

GENERAL WIRING:

It is good practice to have a daily inspection of all electrical wiring on ride. This is done to detect any wires that appear to be damaged, or loose. Check all terminals in control box for security. This is especially important during first month of operation. Vibrations during transportation can cause wires to loosen in the terminals, in turn it will create heat with inevitable damage to components.

HOUSEKEEPING:

Keeping the electrical box and components clean and dry is probably the single most important maintenance tip on the Orbiter Amusement Ride. Keep inside of control box free from clutter and always replace all wiring in channels when finished servicing. As a rule, the main control box should be locked at all times when not servicing. Proximity switches must be kept clean of grease and metal of any kind since they are activated by metal of any kind since they are activated by metal crossing a magnetic field.

CONTROL CONSOLE:

One per month, remove face of console and inspect all wires for security in these terminals.

ELECTRICAL TROUBLESHOOTING

Pump motors won't start	Check electrical connections, supply should be 208/220, 60 cy 3 phase. Check motor over-relay, reset operating motor. If it trips again, inspect condition of motor. Check ground fault relay, both motor and control. If it trips, inspect wiring for loose connections or defective parts. Check time relay 1TR for proper operation of Wye Delta Motor Starter.
Winch will not operate	See Supplement
Control will not activate	Check control and motor ground fault relay. (indicator light on main control) If tripped, check wiring for loose connections, frays or defective parts. Check condition of indicator lamp or slow speed button. Check conditon of key switch. Check proper operation of control relay 1CR.
Slow speed will not operate	Check operation of control relay 6CR. Check wiring to hydraulic valve, solenoid. Check proper operation of bottom proximity switch.
Fast speed will not operate	Check condition of control relay 7CR. Inspect wiring to hydraulic valve solenoid. Check conditon of top unit, proximity switch.
Fast speed will not operate, but ride will raise	Check condition of fast speed solenoid and wiring. If current is to valve, check hydraulic system.

Fast speed will operate, but ride will not raise	Check operation of control relay 7CR and wiring to lift solenoid valve. Check condition of top unit, proximity switch.
Arm will not tilt out fully, are jumping and vibration	Inspect top commutator rings for oil or other foreign matter, clear if necessary. Check connections to tilt cylinder valve solenoid. Check condition and operation of control relay 7CR.
Brake will not operate	Check condition of control relay 6CR and 7CR. Inspect wiring to brake valve solenoid. Check condition of solenoid coil.

ORBITER LUBRICATION CHART

INDEX	UNIT	LOCATION	FREQUENCY	TYPE
1	Main rotation bearing SKF slew ring	Fitting located under main rotating hub, near center lift cylinders, 2 places each side.	Daily	A
2	Main drive gear SKF slew ring	Fitting located at drive pinion gear shield above hydraulic motor, one place.	Daily	A
3	Turret motor supply pump, ring gear	Fittings located between two sweeps at center hub, 3 places.	Daily	A
4	Center slide column, bronze bushings	Fitting located opposite hydraulic motor at column bushing base, one place.	Daily	A
5	Slide column keyway, keyway with key fiber lubricators	Lubrication pots located between center column and main hydraulic reservoir tank.	Daily Keep Full	C
6	Center column lift cylinder, pins	Top and bottom of center lift cylinders, 2 places, each cylinder.	Weekly	B
7	Car turret arm pivot bushings, bronze bushings	Fitting located on end of pivot pin each sweep.	Daily	A
8	Tilt out cylinder bushings, spherical bushings	Fittings located at each end of cylinder (6 cylinders; 2 places each)	Weekly	A
9	Car turret arm bearing SKF slew ring	Fittings accessible through inspection hole. Ride must be rotated in, until fitting is visible through inspection hole.	Daily	A
10.	Car turret arm ring and pinion gear SKF slew ring	Fitting located on pinion fiberglass shield.	Daily	A
11.	Sweep, threaded pins	Pins located where main sweep hinges, 2 pins removed from each of 4 sweeps for fold up must have light coat of grease.	Weekly	A

INDEX	UNIT	LOCATION	FREQUENCY	TYPE
12	Car frame threaded pins	Pins loated where seats fit to turret. 2 pins each car require light coat of grease.	Weekly	A
13	Floor support jacks	Outside edge of floor.	Weekly	B
14	Platform hinges	Each side of trailer where platform hinge.	Monthly	C
15	Hydraulic reservoir	Reservoir located above electric motor.	(replace) Bi-Annually	D