



## **Product Bulletin**

**BULLETIN NO. 031403**

**DATE: March 14, 2003**

**PAGE: 1 of 1**

# Reach Truck Maintenance Requirements

From the industry veterans out there, this topic will certainly elicit a reaction. Anyone who has ever sold or serviced pantograph reach trucks is well aware of the fact that these machines represent a challenge for most maintenance departments.

Especially in high-lift applications, more common today than ever before, pantograph reach trucks tend to require daily attention from the service technician. The higher the lift height, the more stress and strain is placed on the pantograph reach assembly, resulting in accelerated wear and tear on reach arms, bearings/bushings, reach cylinders as well as on mast and outrigger assemblies.

Studying the recommended maintenance procedures outlined by the truck manufacturers in their service manuals, one quickly realizes that these machines tend to be most service department's primary meal ticket. A closer look at the procedures reveals that a typical pantograph truck requires at least one check and possible adjustment for every two hours spent on the job. This in itself can be defined as the epitome of operational inefficiency.

**Now the good news:**

**We have the solution!**

The comparison attached to this product bulletin will examine the major differences between pantograph and moving-mast reach truck designs in regards to required equipment maintenance procedures. More specifically it will highlight the many design features built into each and every Linde R-Series moving-mast reach truck model, with the aim of making this product simpler to maintain over its economic life cycle. The best news of all is that these fantastic trucks are available to the end-user[s] today. Yet they will not only dramatically slash maintenance expenses. They will also contribute mightily towards a safer and more productive material-handling environment, day-after-day.

**Be original...think outside the box!**

Rossler

M.

## Comparison of Reach Truck Maintenance Requirements (Pantograph and Moving Mast Designs)



### Introduction:

For decades electric powered reach trucks have been an integral component of the logistics chain. Without these critical machines the movement of products ranging from after-shave to zinc oxide would not be possible and today's highly discriminating consumers would be highly inconvenienced.

Even though typical North American reach trucks have utilized a pantograph design, more recently newer technologies have made an appearance in the narrow aisle segment of the warehousing industry. With a rapidly growing requirement for increased storage density due to the high cost of available land, warehouse companies and the grocery trade have raised the height of their warehouses in order to conserve precious space. Increased stacking height has contributed significantly to the growth of moving-mast reach trucks in the warehouse and cold storage/freezer sectors. The moving-mast reach truck has been proven superior in terms of load handling capacity at increased lift heights when compared to the pantograph design.

Most users would agree that reach trucks have been synonymous with high maintenance since their inception. The unanswered question to date has been how the maintenance requirements of a typical pantograph truck compare to those of a moving-mast style truck. In an effort to answer this question, the following comparison is provided for your information.

## 2.

When reach trucks first became fixtures in our warehouses during the 1950's and 1960's, pallet stacking pretty much occurred to maximum heights of around 20 feet. Typical pantograph style trucks were more or less able to cope with these lift heights even though they represent a relatively parts and labor-intensive design from a maintenance aspect. Today's warehouse environment has altered the application parameters for reach trucks substantially. Lift heights beyond 30 feet now represent the norm and 35 feet plus is not considered unusual. **These lift heights are rapidly pushing the pantograph design beyond it's practical capabilities from both a capacity as well as maintenance perspective.** At the same time the envelope of safe load handling is stretched as well.

**Moving-mast reach trucks inherently incorporate substantially lower maintenance requirements, even in low-lift applications.** Where higher lifts are the order of the day the difference between the two designs becomes even more apparent. In addition, the moving-mast design, features a seated operator and load handling at a constant load center of 24", thus, contributing towards a more stable vehicle and arguably safer working environment.

We will compare some of the major maintenance requirements of both designs by focusing on the following topics.

### A. Required Lubrication and Truck Adjustments

### B. Reach Mechanisms

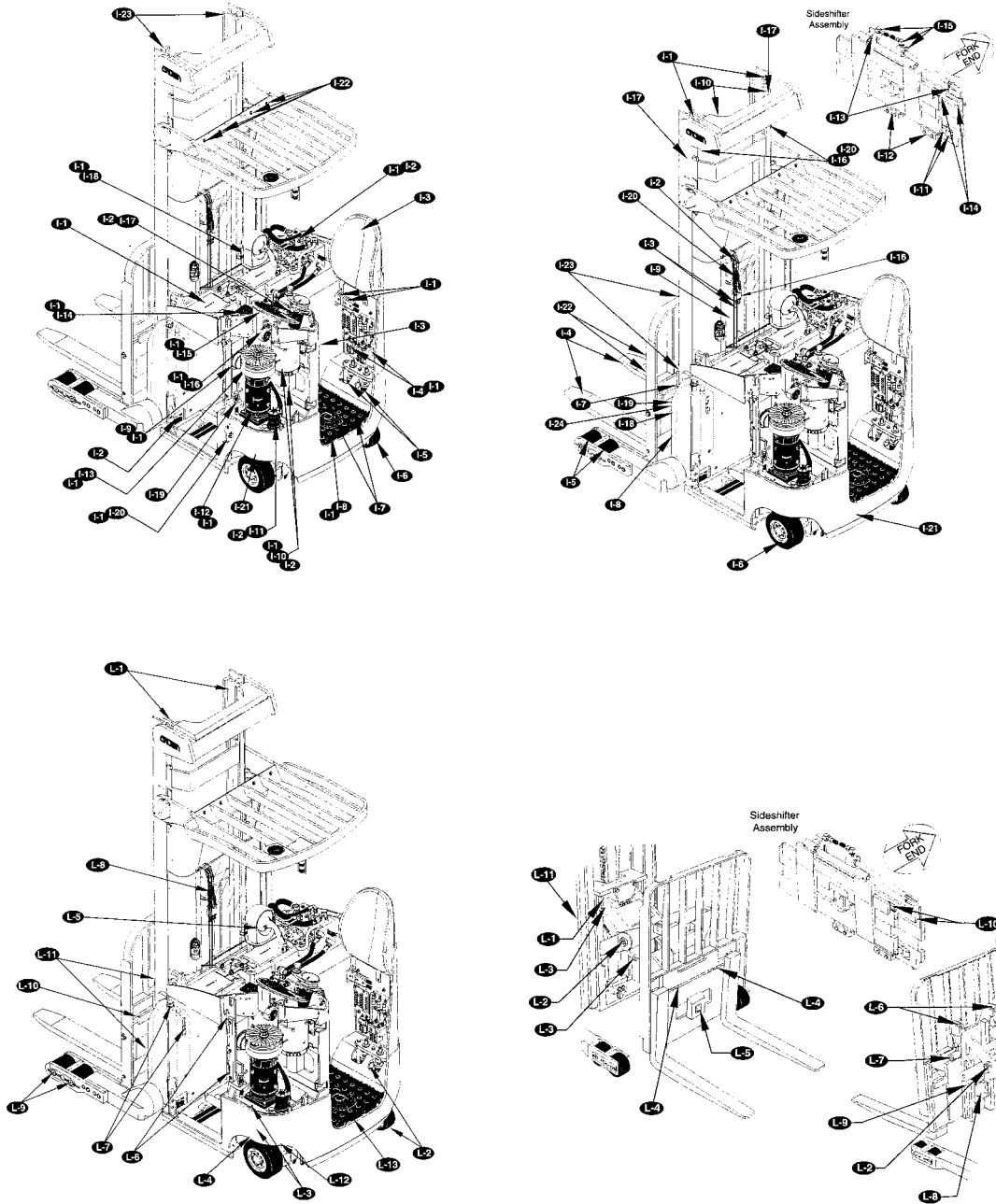
### C. Drive Units and Caster Wheel Assemblies

### D. Load Wheels

### E. Operator Control Handles and Linkage

**A. Required Lubrication and Truck Adjustments:**

We stated earlier that pantograph style reach trucks represented a parts and labor intensive design. Proof of this can be found by examining the published parts/maintenance repair schedules provided by the manufacturers. Illustrated below; are the lubrication and adjustment points for a typical pantograph reach truck as found in the manufacturers published maintenance guidelines.



Illus. 1-4 Pantograph Truck Maintenance Points

4.

The manufacturer suggests checking and adjusting, if necessary, 42 separate items at 100 hr. intervals, 21 additional items at 250 hr. intervals, six additional items at 500 hr. intervals and six additional items at 2000 hr. intervals. **This equates to checking and adjusting, if necessary, 5,190 truck items over 10,000 hours of truck operation.**

Listed below is the published maintenance schedule for the Linde R-Series moving mast range.

Inspection and maintenance schedule	Maintenance			
SERVICE How to perform these functions can be found in the index	EVERY 1000 HOURS (250 HOURS COLD STORE)	EVERY 2000 HOURS (1000 HOURS COLD STORE)	EVERY 5000 HOURS (2500 HOURS COLD STORE)	EVERY 10000 HOURS or 5 years, whichever is earlier (5000 HOURS COLD STORE) (or 30 months, whichever is earlier)
Check the parking brake, adjust if required .....	●			
Check the hydraulic hoses and pipes for damage .....	●			
Check the mast and lift chains for condition and security .....	●			
Lubricate the mast, mast rollers, lift chains and chain pulleys .....	●			
Lubricate mast hose pulley assemblies (cold store version only) .....	●			
Lubricate the reach channels and rollers .....	●			
Lubricate the battery trolley slides and associated mechanism .....	●			
Check the condition and security of motor and battery connectors and cables .....	●			
Check the hydraulic oil level .....	●			
Lubricate the fork carriage and sideshift slider pad .....	●			
Check condition of side guide rollers (option) .....	●			
Lubricate cold store cab hinges and door lock (option) .....	●			
Visual check of motor brushes .....		●		
Check the brake fluid level .....		●		
Check the brake band and load wheel shoes for wear and adjustment .....		●		
Renew the hydraulic tank breather filter .....		●		
Check the reach frame rollers, adjust if necessary .....		●		
Check condition of brake pipes .....			●	
Grease the load wheel bearings .....			●	
Change the hydraulic fluid .....			●	
Renew the hydraulic return line filter .....			●	
Change the brake fluid .....				●

Illus. 5 Linde R-Series Maintenance (PM) Schedule

Suggested maintenance checks/adjustments [PM] on the R-Series total 154 items over 10,000 hours of operation.

Equipment dealer feedback suggests that when following the manufacturers recommended maintenance schedule, the typical pantograph reach truck will require approximately \$1,480.00 in PM parts (Preventive Maintenance) and a minimum of 250 hours of PM labor over 10,000 hours of operation.

This translates into a cost of approx. \$14,000.00, strictly for PM service, when labor expense is indexed at \$50.00/Hr.

The Linde R-Series truck will require \$365.00 in PM parts and 51 hours of PM labor over the same time interval of 10,000 hours. Total PM expense = \$2,915.00. **This results in a user savings of over \$11,000.00 in favor of the Linde R-Series in PM expenses alone.**

## B. Reach Mechanisms:

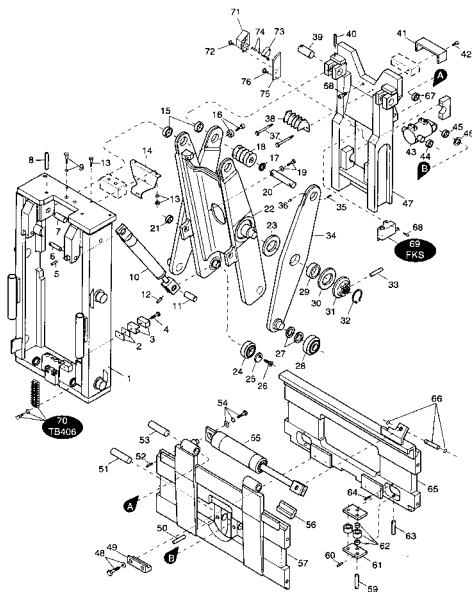
The scissors reach mechanisms found on all pantograph trucks represents the most maintenance intensive component on the entire unit. This mechanism is specifically designed to be lifted, and represents an integral part of the mast structure. It is therefore compact and relatively light by design. At the same time, this mechanism must support 100% of the load to be placed, retrieved, and transported. In addition, this load must be handled at an extended distance of up to 24"- 42" during normal operation depending upon whether we are talking about a single or deep-reach pantograph assembly. This means that pantograph trucks operate at 24", 48" and 72" load centers when handling typical 40" x 48" grocery pallets depending on whether they work with the pantograph mechanism retracted, extended one deep or extended for two deep pallet handling.

**The handling of loads at variable load centers typically results in vastly increased load moments/force, contributing to accelerated wear on support structures such as masts, fork carriages and especially pantograph reach mechanisms.**

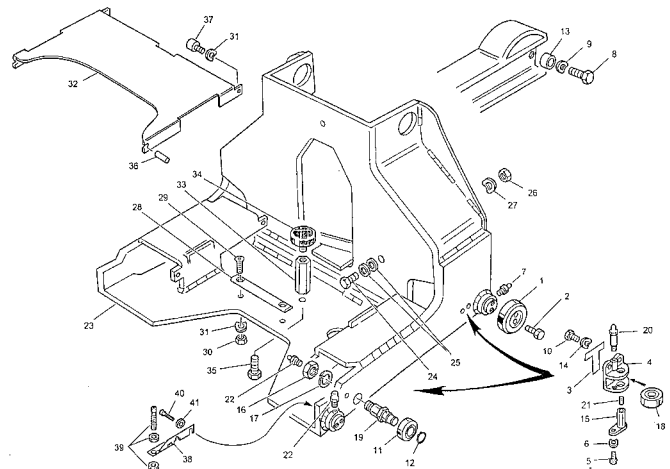
In addition, the scissor style reach mechanism is characterized by a multitude of small high-wear parts such as bearings, bushings, pins, and fasteners requiring constant adjustments/replacement and attention from the maintenance department. In contrast, the front end of a moving-mast reach truck is identical in design to the much more robust counterbalanced truck. Where a pantograph truck reach assembly operates with a total of 10 pivot points requiring pins and bushings, the Linde R-Series only requires four large diameter roller bearings to extend/retract the mast. No increased load moment/force comes to bear on the moving mast carriage and mast due to the fact that all 40" x 48" pallet loads are carried only at a 24" load center. In addition, pantograph reach mechanisms accelerate hydraulic hose wear due to constant hose movements and tight/complex hose routing.

**Due to the simple fact that the reach mechanism on a moving mast style truck never needs to be lifted, it can be constructed in a much more substantial and robust manner, contributing greatly toward overall reduced truck maintenance and extended service life.**

The following two pictures amply illustrate the difference between the reach mechanisms of the two designs with the emphasis on required parts and comparative complexities.



Illus. 6 Pantograph Reach Mechanism



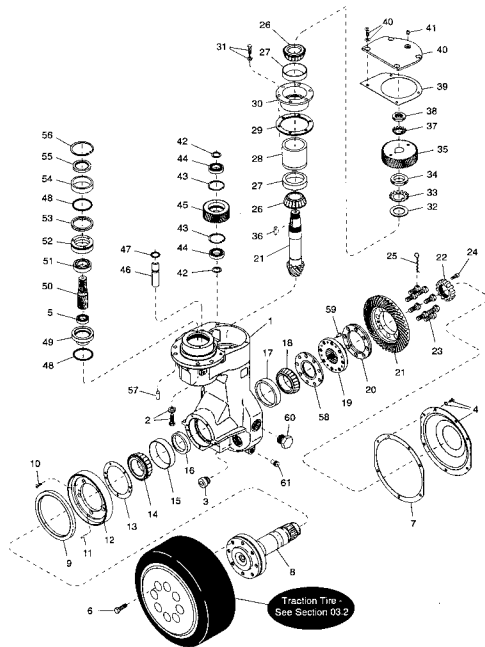
Illus. 7 Moving Mast Reach Mechanism

### C. Drive Units and Caster Wheel Assemblies:

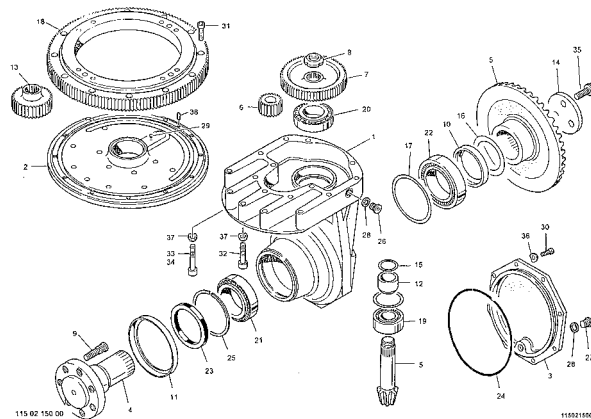
Pantograph style reach trucks are designed to work with both drive wheels and idler/caster wheel assemblies. The later are required to increase truck stability, especially at high lifts due in part to the typically very small diameter, 4"- 6" load wheels utilized. Backing away from a rack with a full load can create a condition known as caster wobble in that the idler wheel is often not connected to a steering linkage and pivots freely. In order to minimize this wobble while still maintaining contact with the ground, these designs are also fitted with undercarriage articulation.

A typical design incorporating all of these assemblies would consist of approximately 240 total parts/components all constructed to enable the truck to travel as intended. In sharp contrast, the drive unit assembly on the Linde R-Series consists of a gear driven axle type gearbox. This design features large diameter bearings, gears, and wheel hub to which an 11" or 14" drive wheel, depending on truck model, is bolted. Working in concert with the trucks large diameter 13" load wheels contributes to a highly stable work platform capable of stacking/retrieving loads in the warehouse as well as loading trailers on the dock.

**Since the R-Series does not require a caster/idler wheel assembly, or any undercarriage articulation we build these trucks with drive units consisting of 102 parts. This means that the Linde R-Series does more work around the warehouse and dock with approximately 56% fewer parts needed in the drive assembly.** In addition, the use of much larger diameter load wheels results in extended load wheel life and a considerable savings in overall maintenance expense. Illustrations 8 – 13 detail the differences between the two designs.

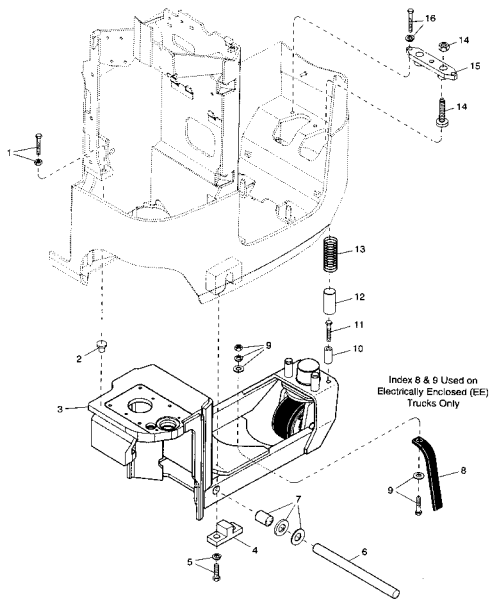


Illus: 8 Pantograph Drive Unit  
(Gear Box)



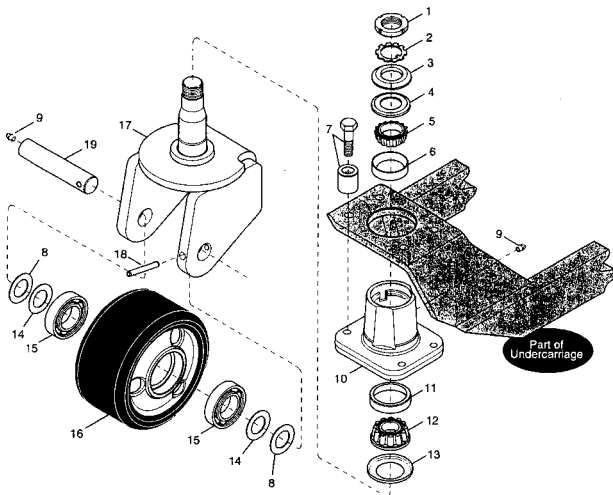
Illus: 9 Linde R-Series Drive Unit  
(Gear Box)

7.



Illus: 10 Pantograph Chassis Articulation

Illus: 11 Linde Chassis Articulation



Illus: 12 Pantograph Idler/Caster Wheel Assembly

Illus: 13 Linde Idler/Caster Wheel Assembly

#### D. Load Wheels:

As already mentioned, overall load wheel life is extended on the moving mast design due to the larger wheels utilized. But there's more. First and foremost on a moving mast truck the brakes are where the load is. As a matter of fact the Linde R-Series features all wheel braking. This makes for a far superior design, capable of moving as well as stopping trucks and rated loads quickly as well as with maximum safety.

The small diameter dual tandem load wheels found on pantograph reach trucks incorporate a myriad of additional hardware. The hydraulically braked load wheel assemblies utilized on the

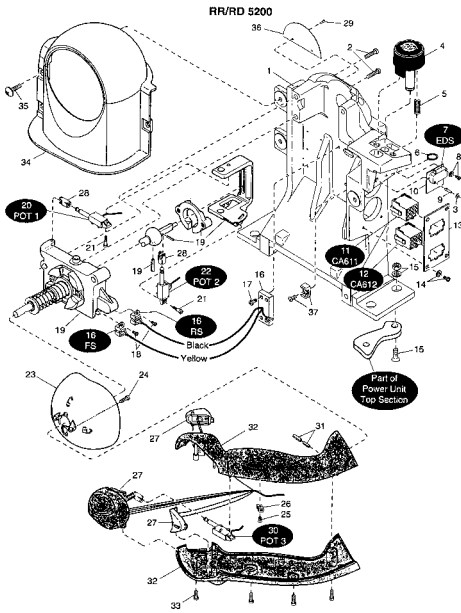
8.

Linde R-Series trucks require approximately 25% fewer service parts than are used on pantograph trucks without load wheel braking systems.

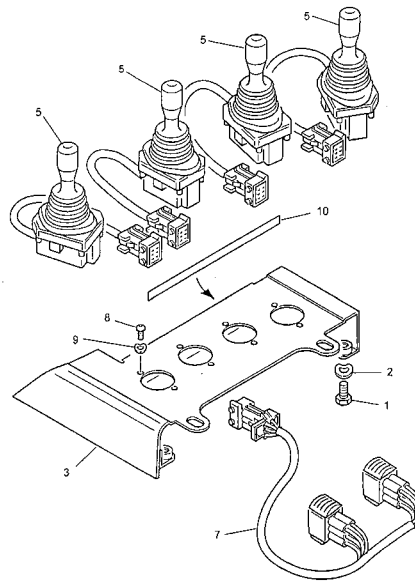
**E. Operator Control Handles and Linkage:**

For some time pantograph reach, trucks have been designed with multi-function type operator control handles. The requirement for these handles to control and meter everything from truck direction and speed to mast lift/lower to reach extension/retraction and fork tilt has resulted in mighty complex control handle assemblies on these products. In contrast, the Linde R-Series, equipped with the patented twin-pedal directional control system, utilizes a simple and highly reliable hydraulic control assembly similar to what is employed on the revolutionary new 39X range of hydrostatic drive trucks. **Where a typical multi-function control handle assembly consists of close to 100 separate parts, the R-Series equivalent requires a mere 17.**

Illustrations 14 and 15 highlight the differences between the two systems. In this case, it is easy to see the benefits of having the operators seated. This simple difference in design philosophies allows them to utilize their feet to select direction and travel speed. This in turn allows for the use of a substantially less complex control handle[s] design. Increased component complexity results in additional maintenance expense as a percentage of the overall cost of truck ownership.



Illus: 14 Pantograph Operator Control Handle Assembly



Illus: 15 Linde Moving Mast Hydraulic Controls

