



## Automated Reach Truck

# R-MATIC (based on R16 HD)

Capacity 1.6 t | Series 1120

### Precise and reliable automation solution for high rack warehouses

- Benchmark with the smallest working aisle width in automated operation
- Unique 3D camera for optimal load detection
- Storage and retrieval up to a height of 11 meters
- 360 degree safety monitoring to detect people or obstacles in the work area
- SLAM (Simultaneous Localization And Mapping) without additional infrastructure



# TECHNICAL DATA (According to VDI 2198)

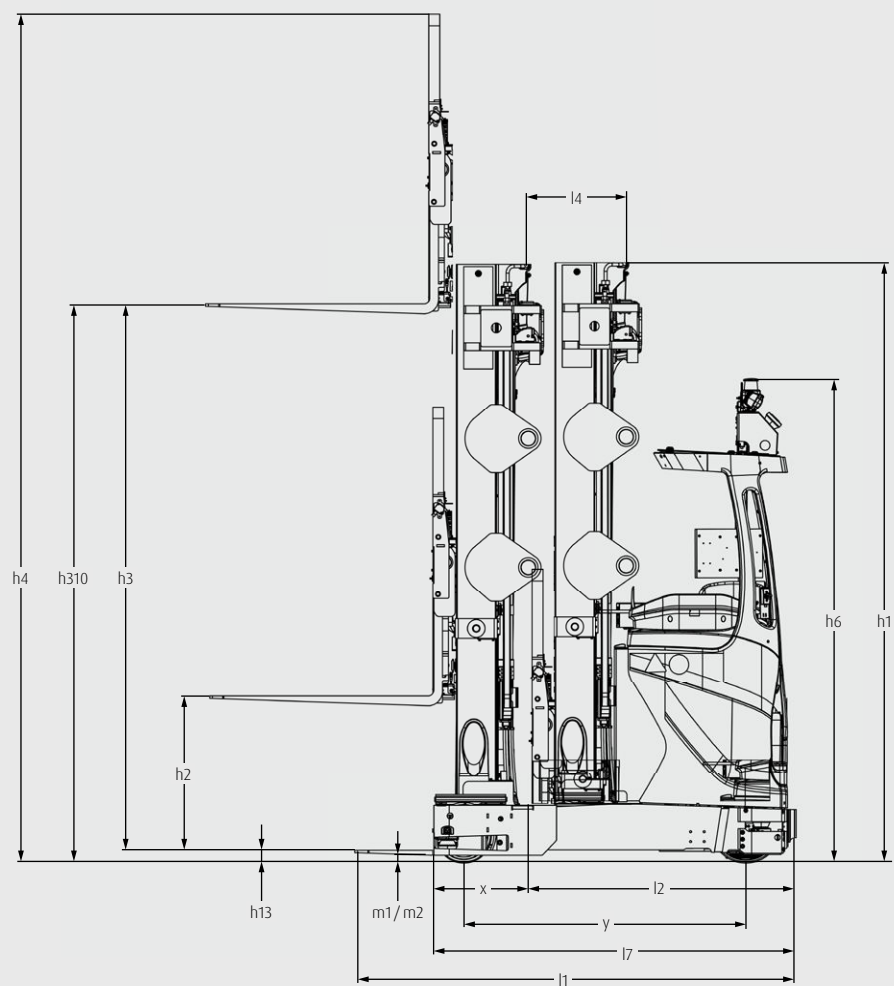
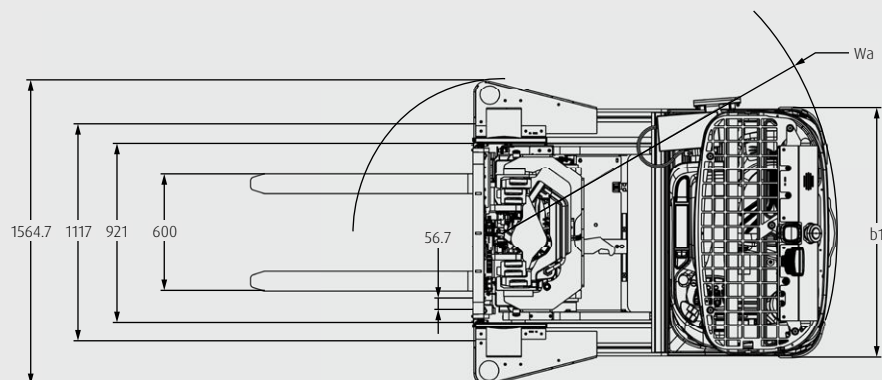
|                 |        |                                                                          |              |                             |                             |                             |                             |
|-----------------|--------|--------------------------------------------------------------------------|--------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Characteristics | 1.1    | Manufacturer                                                             |              | Linde                       | Linde                       | Linde                       | Linde                       |
|                 | 1.2    | Model                                                                    |              | R 16 HD automated config. 1 | R 16 HD automated config. 2 | R 16 HD automated config. 3 | R 16 HD automated config. 4 |
|                 | 1.2a   | Series                                                                   |              | 1120                        | 1120                        | 1120                        | 1120                        |
|                 | 1.3    | Power Unit                                                               |              | Battery                     | Battery                     | Battery                     | Battery                     |
|                 | 1.4    | Operation                                                                |              | Automatic                   | Automatic                   | Automatic                   | Automatic                   |
|                 | 1.5    | Load capacity/Load                                                       | Q (t)        | 1.6                         | 1.6                         | 1.6                         | 1.6                         |
|                 | 1.6    | Load centre                                                              | c (mm)       | 500/600                     | 500/600                     | 500/600                     | 500/600                     |
|                 | 1.8    | Axle Centre to fork face                                                 | x (mm)       | 342                         | 342                         | 342                         | 170                         |
|                 | 1.9    | Wheel base                                                               | y (mm)       | 1453                        | 1453                        | 1453                        | 1453                        |
| Wheels / Tyres  | 3.1    | Tyres rubber, SE, Pneumatic, Polyurethane                                |              | Polyurethane                | Polyurethane                | Polyurethane                | Polyurethane                |
|                 | 3.2    | tyre size, front                                                         | (mm)         | Ø 360 × 130                 | Ø 360 × 130                 | Ø 360 × 130                 | Ø 360 × 130                 |
|                 | 3.3    | tyre size, rear                                                          | (mm)         | Ø 285 × 100                 | Ø 285 × 100                 | Ø 285 × 100                 | Ø 285 × 100                 |
|                 | 3.5    | Wheels, number front / rear (x = driven)                                 |              | 1x/2                        | 1x/2                        | 1x/2                        | 1x/2                        |
|                 | 3.7    | Track width, rear                                                        | b11 (mm)     | 1167                        | 1167                        | 1167                        | 1167                        |
| Dimensions      | 4.1    | Mast/fork carriage tilt, forward/backward                                | a/b(°)       | 0/0                         | 0/0                         | 0/0                         | 0/0                         |
|                 | 4.2    | Height of mast lowered                                                   | h1 (mm)      | 2980                        | 3530                        | 3880                        | 4930                        |
|                 | 4.3    | free lift                                                                | h2 (mm)      | 1774                        | 2324                        | 2674                        | 3725                        |
|                 | 4.4    | Lift                                                                     | h3 (mm)      | 6879                        | 8479                        | 9679                        | 11379                       |
|                 | 4.5    | Height of mast, extended                                                 | h4 (mm)      | 7965/8414                   | 9565/10014                  | 10765/11214                 | 12465/12914                 |
|                 | 4.7    | Height of overhead Guard (cabin or A-frame)                              | h6(mm)       | 2495                        | 2495                        | 2495                        | 2495                        |
|                 | 4.8    | Height of seat/stand on platform                                         | h7 (mm)      | 910 – 1040                  | 910 – 1040                  | 910 – 1040                  | 910 – 1040                  |
|                 | 4.10   | Height of reach legs                                                     | h8 (mm)      | 307.5 – 348                 | 307.5 – 348                 | 307.5 – 348                 | 307.5 – 348                 |
|                 | 4.19   | Overall Length                                                           | l1 (mm)      | 2475                        | 2475                        | 2475                        | 2647                        |
|                 | 4.20   | Length to fork face                                                      | l2 (mm)      | 1370                        | 1370                        | 1370                        | 1542                        |
|                 | 4.21   | Overall width front                                                      | b1/b2 (mm)   | 1290/1570                   | 1290/1570                   | 1290/1570                   | 1290/1570                   |
|                 | 4.22   | Fork dimensions DIN ISO 2331                                             | s/e/l (mm)   | 45 × 100 × 1150             | 45 × 100 × 1150             | 45 × 100 × 1150             | 45 × 100 × 1150             |
|                 | 4.23   | Fork carriage to ISO 2328, class/type A, B                               |              | ISO 2B                      | ISO 2B                      | ISO 2B                      | ISO 2B                      |
|                 | 4.24   | Width of fork carriage                                                   | b3 (mm)      | 937                         | 937                         | 937                         | 937                         |
|                 | 4.25   | Fork spread                                                              | b5 (mm)      | 471/710                     | 471/710                     | 471/710                     | 471/710                     |
|                 | 4.26   | Distance between wheel arms/loading surfaces                             | b4 (mm)      | 920                         | 920                         | 920                         | 920                         |
|                 | 4.28   | Reach Travel                                                             | l4 (mm)      | 537                         | 537                         | 537                         | 365                         |
|                 | 4.31   | Ground Clearance, below mast                                             | m1 (mm)      | 40                          | 40                          | 40                          | 40                          |
|                 | 4.32   | Ground Clearance, centre of wheelbase                                    | m2 (mm)      | 44                          | 44                          | 44                          | 44                          |
|                 | 4.34.1 | Aisle width for Pallets 1000 × 1200 crossways (AUTOMATIC) <sup>1)</sup>  | Ast (mm)     | 3100                        | 3100                        | 3100                        | 3250                        |
|                 | 4.34.2 | Aisle width for Pallets 800 × 1200 along forks (AUTOMATIC) <sup>2)</sup> | Ast (mm)     | 3000                        | 3000                        | 3000                        | 3200                        |
| Performance     | 4.35   | front Turning Radius auto mode                                           | Wa_auto (mm) | 1808                        | 1808                        | 1808                        | 1808                        |
|                 | 4.37   | Length of Chassis                                                        | l7 (mm)      | 1872                        | 1872                        | 1872                        | 1872                        |
|                 | 5.1    | Travel Speed, (forward/backward)                                         | (m/s)        | 1.95/0.75                   | 1.95/0.75                   | 1.95/0.75                   | 1.95/0.75                   |
|                 | 5.2    | Lifting speed, with/without load                                         | (m/s)        | 0.52/0.66                   | 0.52/0.66                   | 0.52/0.66                   | 0.52/0.66                   |
|                 | 5.3    | Lowering speed with/without load                                         | (m/s)        | 0.55/0.44                   | 0.55/0.44                   | 0.55/0.44                   | 0.55/0.44                   |
|                 | 5.4    | Reach speed, with/without load                                           | (m/s)        | 0.2                         | 0.2                         | 0.2                         | 0.2                         |
| Drive           | 5.8    | Maximum Climbing ability, with/without load                              | %            | 44258                       | 44258                       | 44258                       | 44258                       |
|                 | 5.10   | Service brake                                                            |              | hydr./mech.                 | hydr./mech.                 | hydr./mech.                 | hydr./mech.                 |
|                 | 6.1    | Drive motor rating S2 60 min                                             | (kW)         | 6.5                         | 6.5                         | 6.5                         | 6.5                         |
|                 | 6.2    | Lift Motor Rating at S3 15 %                                             | (kW)         | 14                          | 14                          | 14                          | 14                          |
|                 | 6.3    | Battery according to DIN 43531/35/36/A, B, Cn no                         |              | 3/3                         | 3/3                         | 3/3                         | 3/3                         |
|                 | 6.4    | Battery voltage/ rated capacity                                          | (V/Ah)       | 48/560                      | 48/560                      | 48/560                      | 48/700                      |
|                 | 6.5    | Battery weight (± 5 %)                                                   | (kg)         | 896                         | 896                         | 896                         | 939                         |
|                 | 6.6    | Power consumption in relation to VDI Cycle (15 cycles/1 h)               | (kWh/h)      | 1.59                        | 1.59                        | 1.59                        | 1.59                        |

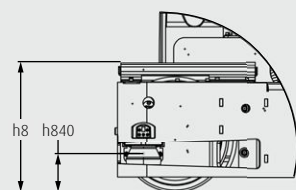
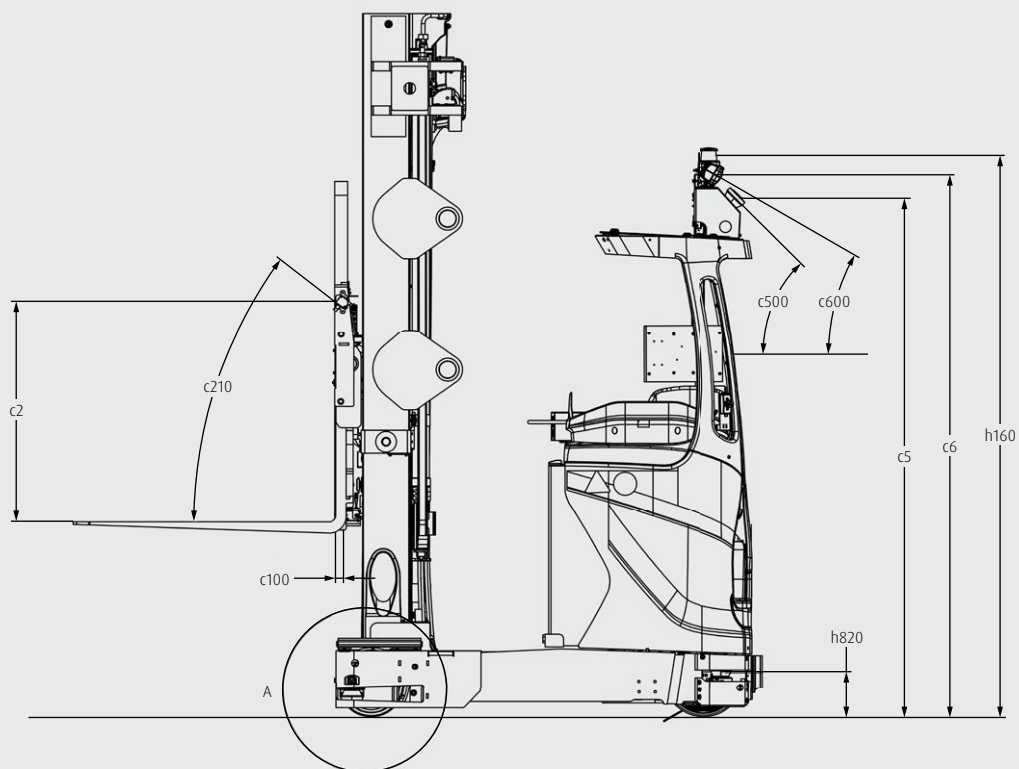
1) Depends on customer project conditions

2) Max. 25 mm overhang included

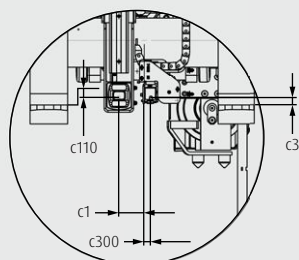
# TECHNICAL DATA (According to VDI 2198)

|                       |                                                              |                |                             |                             |                             |                             |
|-----------------------|--------------------------------------------------------------|----------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
|                       | Manufacturer                                                 |                | Linde                       | Linde                       | Linde                       | Linde                       |
|                       | Model                                                        |                | R 16 HD automated config. 1 | R 16 HD automated config. 2 | R 16 HD automated config. 3 | R 16 HD automated config. 4 |
| Dimensions AGV        | Power Unit Compartment size                                  |                | 4 PZS                       | 4 PZS                       | 4 PZS                       | 5 PZS                       |
|                       | Mast                                                         |                | 6955 / 2980 / 1850          | 8555 / 3530 / 2400          | 9755 / 3880 / 2750          | 11455 / 4930 / 3800         |
|                       | Maximum forks height                                         | h310 (mm)      | 6924                        | 8524                        | 9724                        | 11424                       |
|                       | Backrest Height                                              | h900 (mm)      | 1041 / 1490                 | 1041 / 1490                 | 1041 / 1490                 | 1041 / 1490                 |
|                       | Maximum drop height                                          | (mm)           | 6524                        | 8124                        | 9324                        | 11024                       |
|                       | Maximum pick height                                          | (mm)           | 6774                        | 8374                        | 9574                        | 11274                       |
|                       | Localisation sensor scan height                              | h610 (mm)      | 2476                        | 2476                        | 2476                        | 2476                        |
|                       | Front Safety Scan height                                     | h810 (mm)      | 195                         | 195                         | 195                         | 195                         |
|                       | Lateral Safety Scan height                                   | h820 (mm)      | 195                         | 195                         | 195                         | 195                         |
|                       | Rear Safety Scan height                                      | h840 (mm)      | 103                         | 103                         | 103                         | 103                         |
|                       | Rear Turning Radius (800 / 1000 / 1200 load width) auto mode | Wb_auto (mm)   | 1002 / 1065 / 1065          | 1002 / 1065 / 1065          | 1002 / 1065 / 1065          | 1137 / 1184 / 1184          |
|                       | Front Turning Radius auto mode                               | Wa_auto (mm)   | 1808                        | 1808                        | 1808                        | 1808                        |
|                       | Overall length manual                                        | l1 (mm)        | 2476                        | 2476                        | 2476                        | 2476                        |
|                       | Length to fork face                                          | l2 (mm)        | 1370                        | 1370                        | 1370                        | 1542                        |
|                       | Reach travel                                                 | l4 (mm)        | 537                         | 537                         | 537                         | 365                         |
|                       | Ground clearance, below mast                                 | m1 (mm)        | 40                          | 40                          | 40                          | 40                          |
|                       | Ground clearance, centre of wheelbase                        | m2 (mm)        | 44                          | 44                          | 44                          | 44                          |
|                       | Side shift actuator stroke                                   | ± mm           | 80                          | 80                          | 80                          | 80                          |
| Accuracy AGV          | Lift control accuracy                                        | ± mm           | 10                          | 10                          | 10                          | 10                          |
|                       | Sideshift control accuracy                                   | ± mm           | 5                           | 5                           | 5                           | 5                           |
|                       | Truck longitudinal positioning precision at standstill       | ± mm           | 20                          | 20                          | 20                          | 20                          |
|                       | Truck lateral positioning precision at standstill            | ± mm           | 20                          | 20                          | 20                          | 20                          |
| Speed AGV             | Sideshifting speed                                           | (m / s)        | 0.1                         | 0.1                         | 0.1                         | 0.1                         |
|                       | Maximal Lateral Speed, with / without load                   | (m / s)        | 0.45 / 0.45                 | 0.45 / 0.45                 | 0.45 / 0.45                 | 0.45 / 0.45                 |
| Detection devices AGV | Distance 3D camera to median plan                            | c1 (mm)        | 63                          | 63                          | 63                          | 63                          |
|                       | Distance 3D camera to the backrest                           | c100 (mm)      | 26                          | 26                          | 26                          | 26                          |
|                       | Distance 3D camera to the top of the forks                   | c110 (mm)      | 190                         | 190                         | 190                         | 190                         |
|                       | Distance overhang sensors to the top of the forks            | c2 (mm)        | 1432                        | 1432                        | 1432                        | 1432                        |
|                       | Overhang sensors centerline distance                         | c200 (mm)      | 907                         | 907                         | 907                         | 907                         |
|                       | Overhang sensors projection distance                         | c210 (mm)      | 1150                        | 1150                        | 1150                        | 1150                        |
|                       | Distance rangefinder to median plan                          | c3 (mm)        | 11 (0...31)                 | 11 (0...31)                 | 11 (0...31)                 | 11 (0...31)                 |
|                       | Distance rangefinder to median plan                          | c300 (mm)      | 20                          | 20                          | 20                          | 20                          |
|                       | Distance vertical rangefinder to top of the forks            | c4 (mm)        | 370                         | 370                         | 370                         | 370                         |
|                       | Distance vertical rangefinder to median plan                 | c400 (mm)      | 56                          | 56                          | 56                          | 56                          |
|                       | Curtain laser height                                         | c5 (mm)        | 2272                        | 2272                        | 2272                        | 2272                        |
|                       | Curtain laser projection distance                            | c500 (mm)      | 2530                        | 2530                        | 2530                        | 2530                        |
|                       | Bluespot™ height                                             | c6 (mm)        | 2361                        | 2361                        | 2361                        | 2361                        |
|                       | Bluespot™ projection distance                                | c600 (mm)      | 4000                        | 4000                        | 4000                        | 4000                        |
|                       | Inductive sensor "high" height                               | c7 (mm)        | 682                         | 682                         | 682                         | 682                         |
|                       | Barcode reader 1D / 2D, position 1                           | c9 / c900 (mm) | 80 / 876                    | 80 / 876                    | 80 / 876                    | 80 / 876                    |
|                       | Barcode reader 1D / 2D, position 2                           | c9 / c900 (mm) | 80 / 932                    | 80 / 932                    | 80 / 932                    | 80 / 932                    |
|                       | Barcode reader 1D / 2D, position 3                           | c9 / c900 (mm) | 788 / 876                   | 788 / 876                   | 788 / 876                   | 788 / 876                   |
|                       | Barcode reader 1D / 2D, position 4                           | c9 / c900 (mm) | 788 / 932                   | 788 / 932                   | 788 / 932                   | 788 / 932                   |

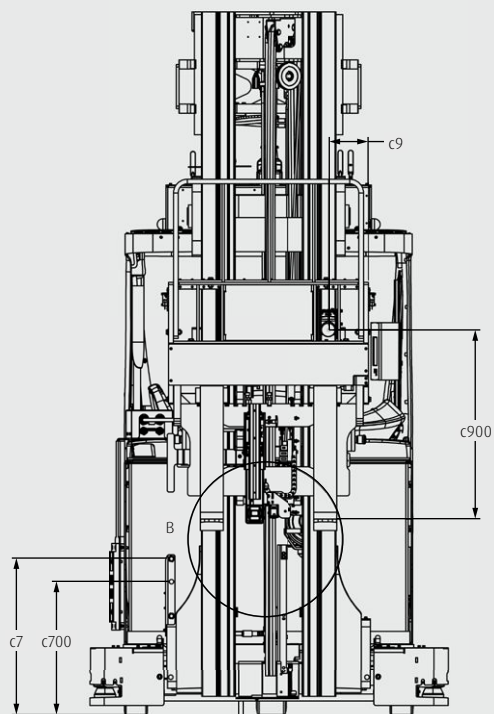




Detail A



Detail B



# MAST TABLES

## TRIPLEX MAST (in mm)

|                     |                      |                      |                      |                      |                      |                       |                       |                       |
|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|-----------------------|-----------------------|
| Series              | 1502                 |                      |                      |                      |                      |                       |                       |                       |
| Lift                | h3: 6879             |                      | h3: 8479             |                      | h3: 9679             |                       | h3: 11379             |                       |
| Height measurements | h1: 2980<br>h3: 6879 | h2: 1774<br>h4: 7965 | h1: 3530<br>h3: 8479 | h2: 2324<br>h4: 9565 | h1: 3880<br>h3: 9679 | h2: 2674<br>h4: 10765 | h1: 4930<br>h3: 11379 | h2: 3725<br>h4: 12465 |
| Model               |                      |                      |                      |                      |                      |                       |                       |                       |
| R16 HD              | ○                    |                      | ○                    |                      | ○                    |                       | ●                     |                       |

● Standard equipment      ○ Optional equipment

**h1:** Height of mast, lowered      **h2:** Free lift      **h3:** Lift      **h4:** Height of mast, extended

# STANDARD AND OPTIONAL EQUIPMENT

| Model/ Equipment   |                                                       | R16 HD |
|--------------------|-------------------------------------------------------|--------|
| Off Board Software | Advanced routing algorithm                            | ●      |
|                    | Editor for integration of different rack types        | ●      |
|                    | Smart AGV charging logic                              | ○      |
|                    | Interfaces to existing WMS, ERP, ...                  | ●      |
|                    | Interfaces with infrastructure: doors, conveyors, ... | ●      |
|                    | Linde WMS system                                      | ○      |
|                    | Mail information on AGV performance                   | ●      |
| On Board Software  | Load detection via 3D point cloud analysis            | ●      |
|                    | SLAM navigation                                       | ●      |
|                    | User friendly Log-file analysis                       | ●      |
|                    | Self-calibration algorithm                            | ●      |
| Safety             | Anti-drag or push detection of load unit              | ●      |
|                    | 2D Curtain laser in front direction                   | ●      |
|                    | BlueSpot™ for visual warning                          | ●      |
|                    | Additional emergency buttons on Mast                  | ●      |
|                    | Safety edges to detect load tipping in curves         | ○      |
|                    | Acoustic warning indicators                           | ○      |
| Load Handling      | 3D camera perception for load detection               | ●      |
|                    | 2D Barcode reader                                     | ○      |
|                    | Overhang sensors                                      | ○      |
|                    | Modular Backrest heights                              | ○      |
| Environment        | Wifi Communication                                    | ●      |
|                    | HMI - User Monitor in cabin                           | ●      |
|                    | Communication Box (ComBox)                            | ●      |
| Mast/ Forks        | 4 × Standard Triplex mast                             | ○      |
|                    | ISO forks                                             | ●      |
|                    | Other masts and forks as customer option              | ○      |
| Energy             | Lead Acid battery for manual charging                 | ●      |
|                    | TPPL battery for automated charging                   | ○      |

● Standard equipment

○ Optional equipment



Customer process focus as a standard

### Sales and Realization

- Project specific concept design of the automated solution including dynamic simulation and proof of concept on site if necessary
- Combination of manual handling processes and degree of automation can be optimized to fit the customer needs
- One face to the customer for the whole process from first contact to the lifecycle phase
- Intelligent, scalable software solutions to provide customers best control on their processes
- Project Management and Commissioning according to Linde standards with unified tools and templates in the entire network
- Realization expertise for project steering since 2015 with more than 600 installed AGV's

## CHARACTERISTICS



360 degree safety

### Safety

- 360° safety concept for personal protection all around the vehicle
- 2D curtain laser in front of the vehicle to detect higher obstacles
- Real time speed-adaptive detection fields
- Mixed environment with operators and other trucks



Unique 3D load-perception

### Handling

- Multiple loads type handling through innovative 3D camera perception
- Proven reliability for application up to 24/7
- Optimized pick and drop processes
- Speed adjustments according to environmental situations
- Touch screen with easy user interface
- Overall control software for task, traffic and energy management



Low maintenance design

### Service

- AGVs based on robust and well known LMH base trucks
- Service coverage by existing LMH network supplemented by central hotline support
- Mostly use of standard (customer / AGV independent) spare parts
- Improved stocking concept, reduced costs (compared to other AGV solutions)

Subject to modification in the interest of progress. Illustrations and technical details could include options and not binding for actual constructions. All dimensions subject to usual tolerances.

Presented by:



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