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Politécnica** - La Almunia
Centro adscrito
Universidad Zaragoza

**ESCUELA UNIVERSITARIA POLITÉCNICA
DE LA ALMUNIA DE DOÑA GODINA (ZARAGOZA)**

ANEXOS

Automatización intralogística de nave industrial
mediante robots AGV

Intralogistics automation of an industrial
warehouse using AGV robots

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1. PLANOS

1.1. PLANO NAVE DISTRIBUCIÓN FINAL

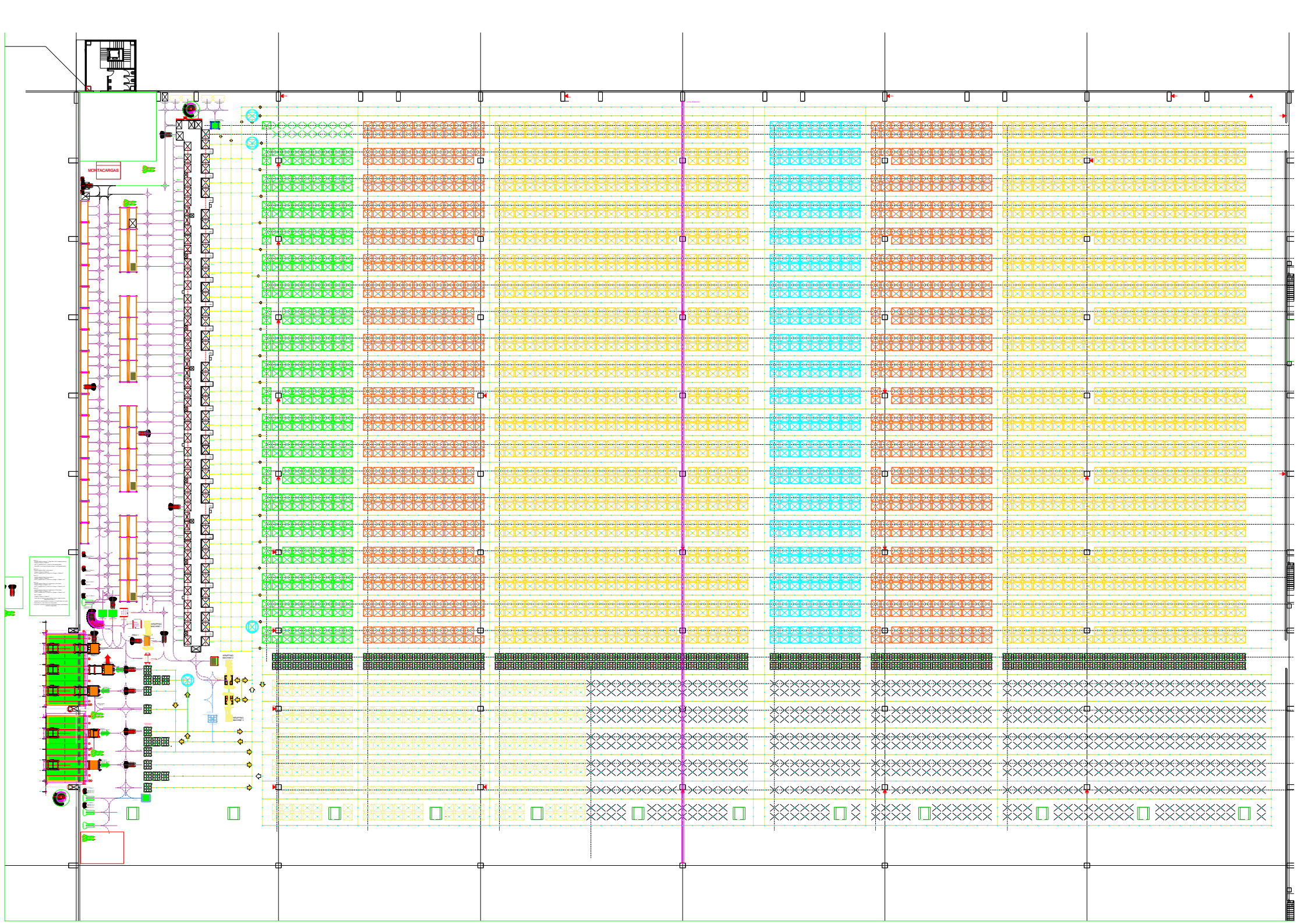
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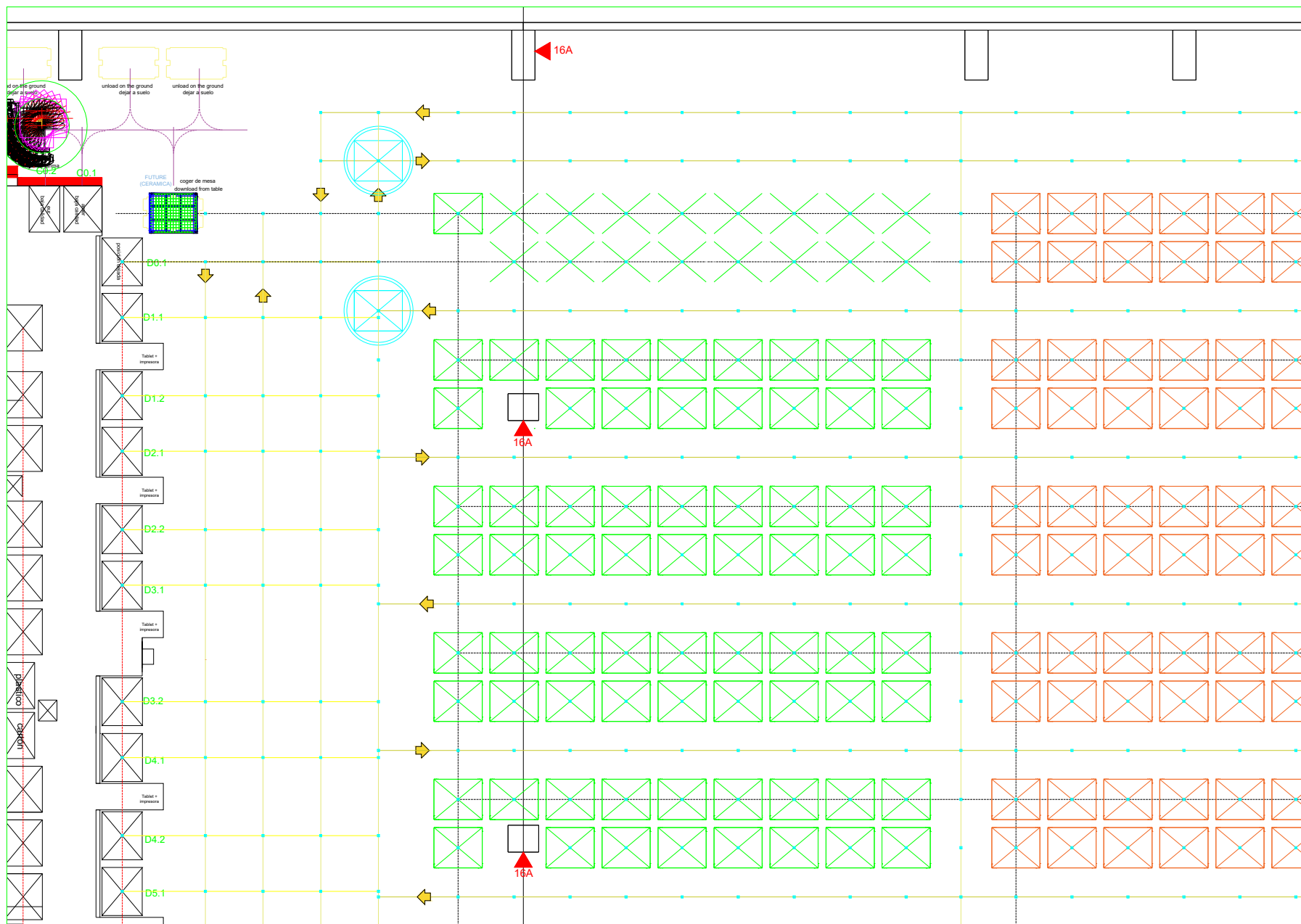
1.3. ZONA DE PICKING CON AGVs DE HORQUILLAS

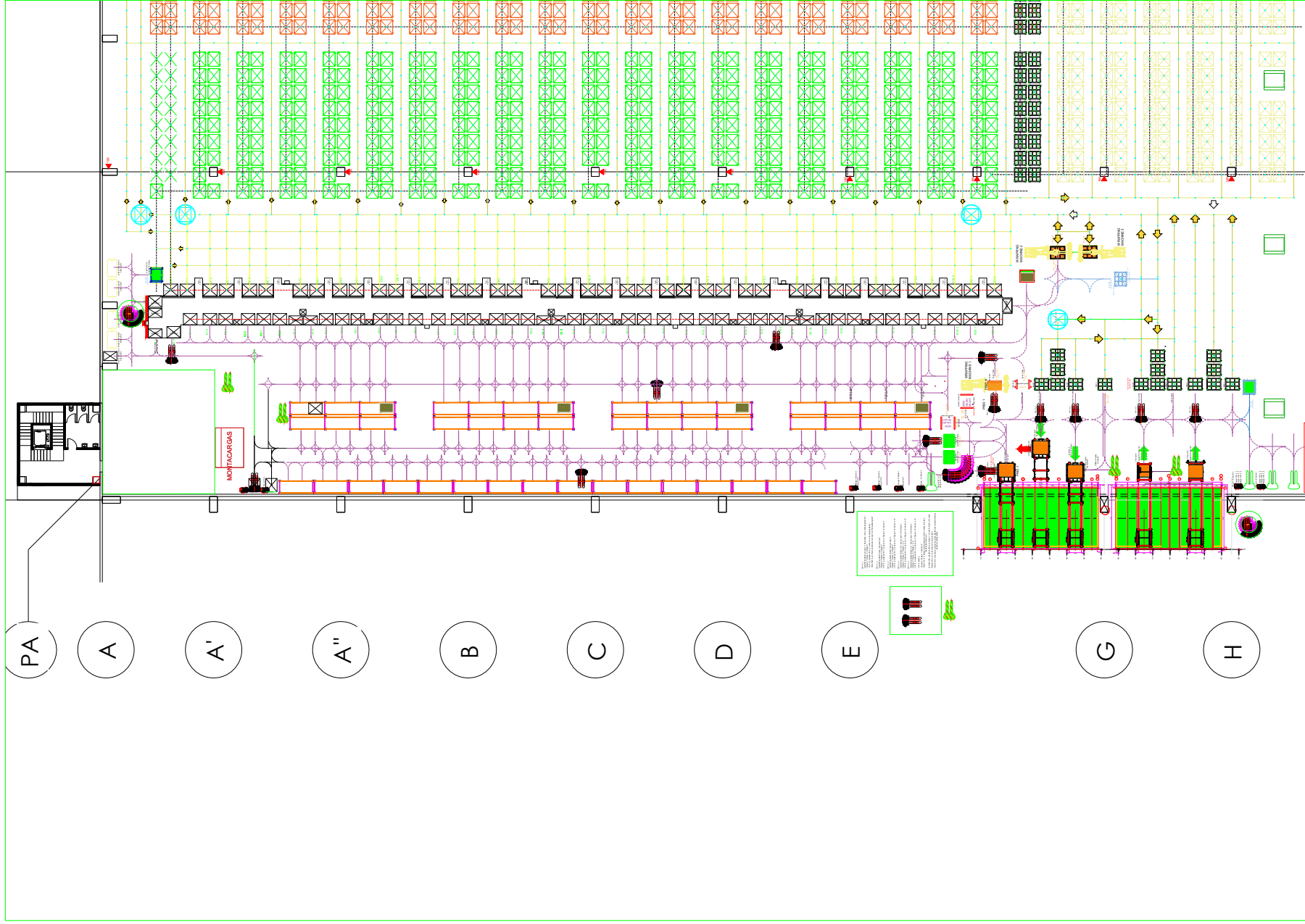
1.4. ESPECIFICACIONES TÉCNICAS AGV VISIONNAV

1.5. PLANO MESA PARA AGV DE PLATAFORMA

1.6. ESTRUCTURA MEZZANINES PARA ZONA PICKING

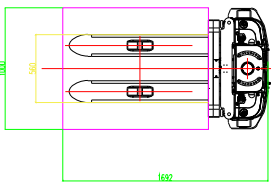
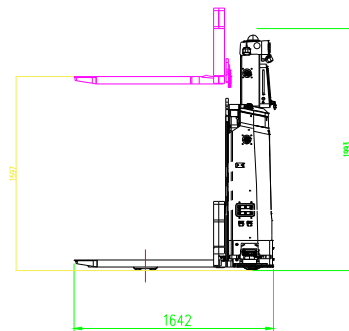






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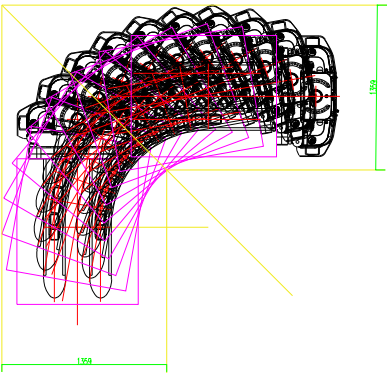
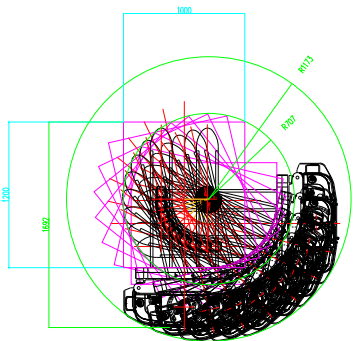
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Instrucciones opcionales:
La altura del mástil es opcional de 3000 mm;
La longitud de la horquilla se puede personalizar;

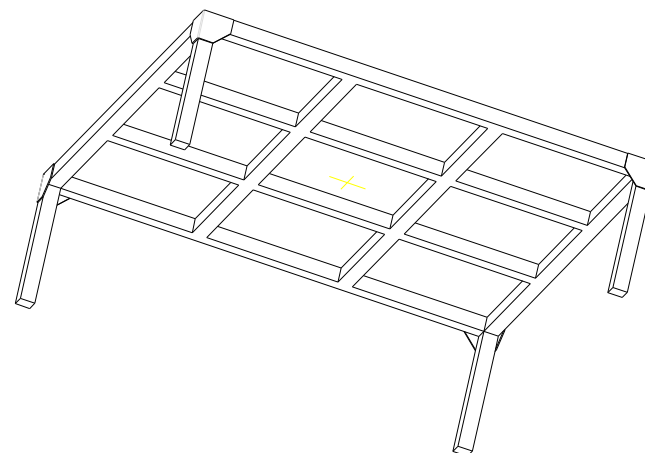
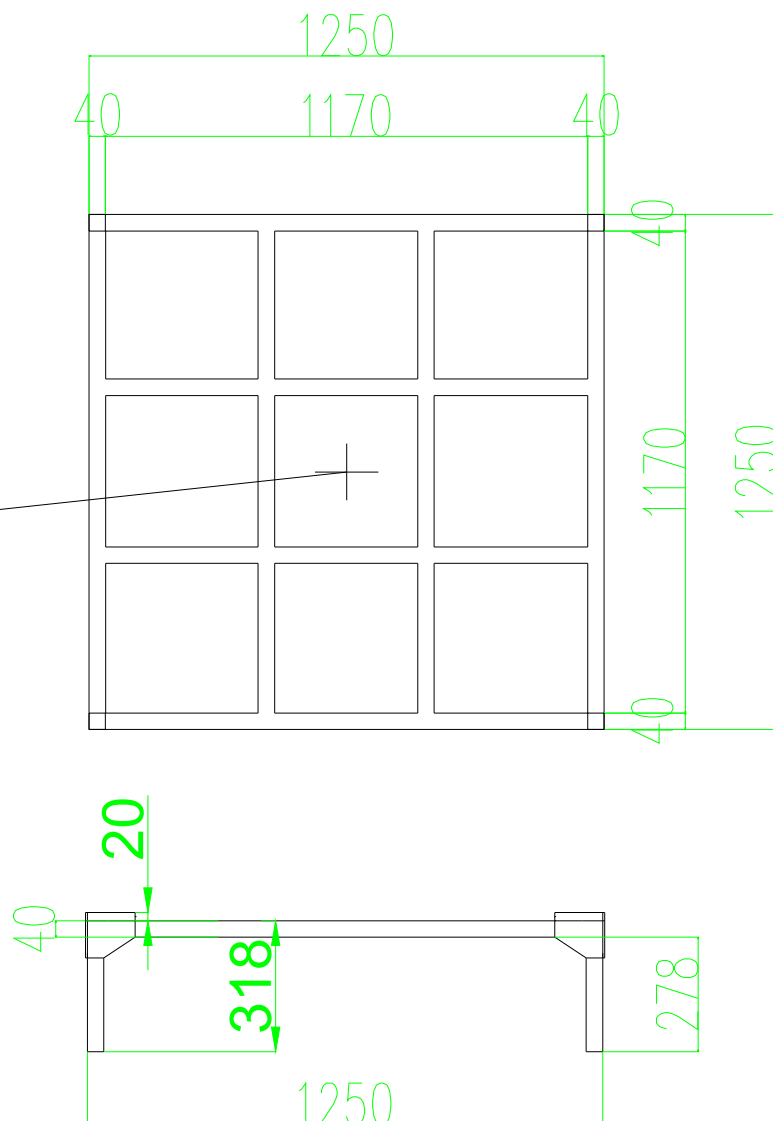
MB14F90 (SLIM14)
CAPACITY CHART

h3 (mm)	Q (kg)		
3500	850	700	550
3000	1000	850	700
2500	1200	1000	850
1600	1400	1200	1000
LOAD CENTER (mm)			
	600	700	800

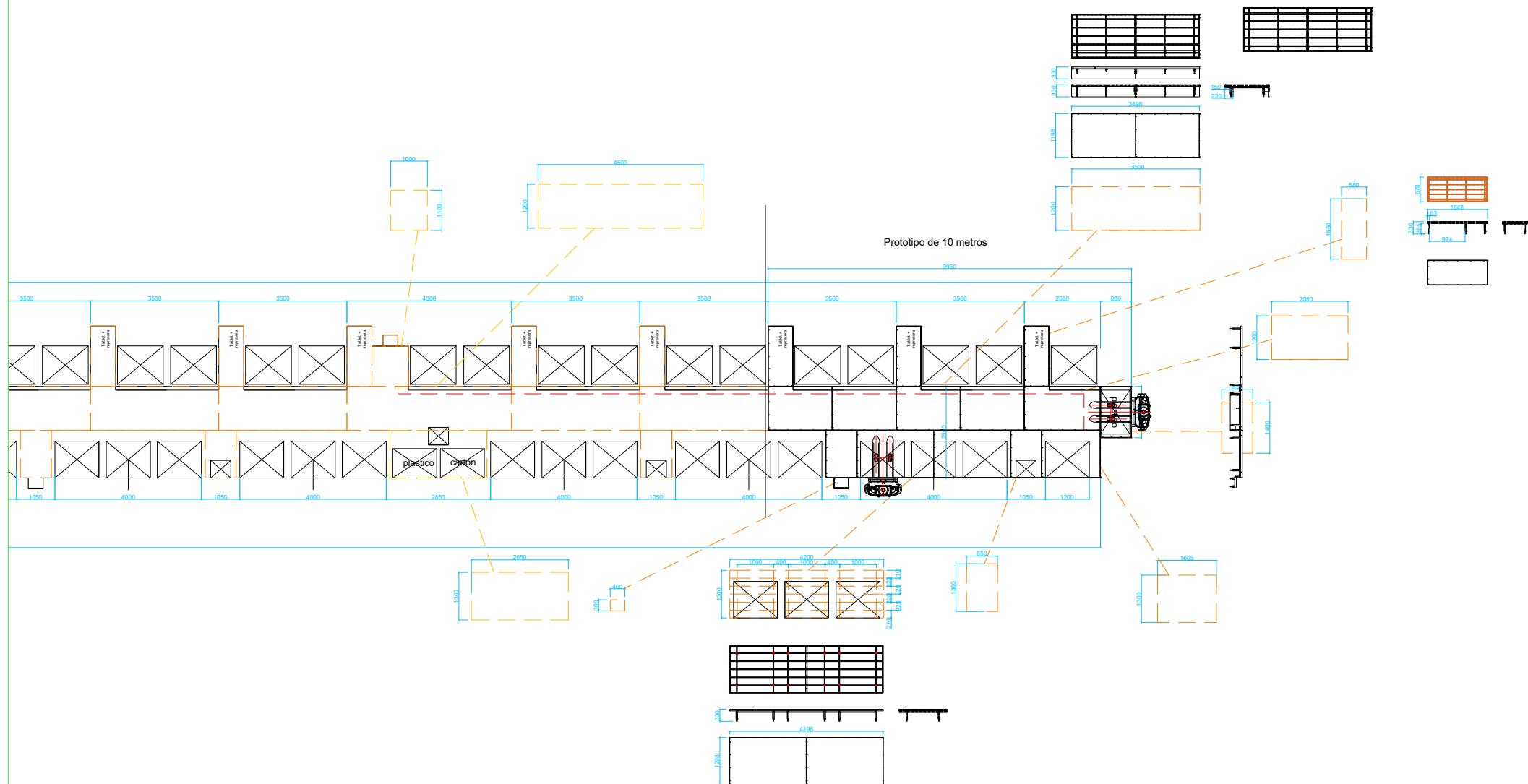


Ancho del canal de giro en ángulo recto
 $W = S' + 200 * 2 = 1359 + 400 = 1759 \text{ mm}$

Cruz



- 1、Material: Q235
- 1.1: Tabique: 40*40*2mm Tubo cuadrado, Viga transversal: 40*40*2mm, 底部井字结构;
Placa base (T2mm)
- 2、Soldadura y Rectificado:
 - 2.1: Soldadura completa entre los tubos cuadrados del bastidor inferior, soldadura interrumpida entre los tubos cuadrados y las placas de acero trayectorias de soldadura de 20 mm de longitud, espaciado no superior a 200 mm.
- 3、Error diagonal del bastidor inferior tras la soldadura $\leq 2,0$ mm, planitud de las superficies superior e inferior $\leq 2,0$ mm.
- 4、Color: RAL7035 Gris/negro, Pulverización
- 5、Cruz del estante:
 - 5.1: Cruz: 100*100mm, anchura 0.5mm, Error de posición $\leq 1,0$ mm
Error angular $\leq 0,5^\circ$
Colocado en una placa de acero enrasada en la superficie inferior del bastidor inferior
- 6、Carga total del estante 1000KG



2. FICHAS TÉCNICAS

2.1. DATASHEET Q7-1000 HIK

2.2. DATASHEET VNSL14 VISIONNAV

2.3. FICHA TÉCNICA ENFARDADORA DE PALETS

2.4. REQUISITOS PARA APILAR EN CONVEYORS DE
VISIONNAV

2.5. REQUERIMIENTOS DE PASILLO PARA AGV DE
PLATAFORMA

MR-Q7-1000LE-DI(CE)

LMR Series



Key Feature

- Uses inertial, QR code based navigation and Laser-SLAM navigation to achieve accurate positioning.
- Supports smooth motions via dual-wheel differential drive.
- Supports multi-level electrical threshold, auto-charge and back to work on battery dependency.
- Multi-safety protection: laser obstacle avoidance, bumper strip, emergency stop button etc.
- User friendly: supports LCD screen and sound alert.
- Supports carrying up to 1000 kg loads.
- Uses sound and dual-color indicator to prompt device status.
- Supports wireless communication and roaming in network covered area.

Typical Application

Warehousing and logistics industries include e-Commerce, electronics manufacturing, tobacco, medicine.

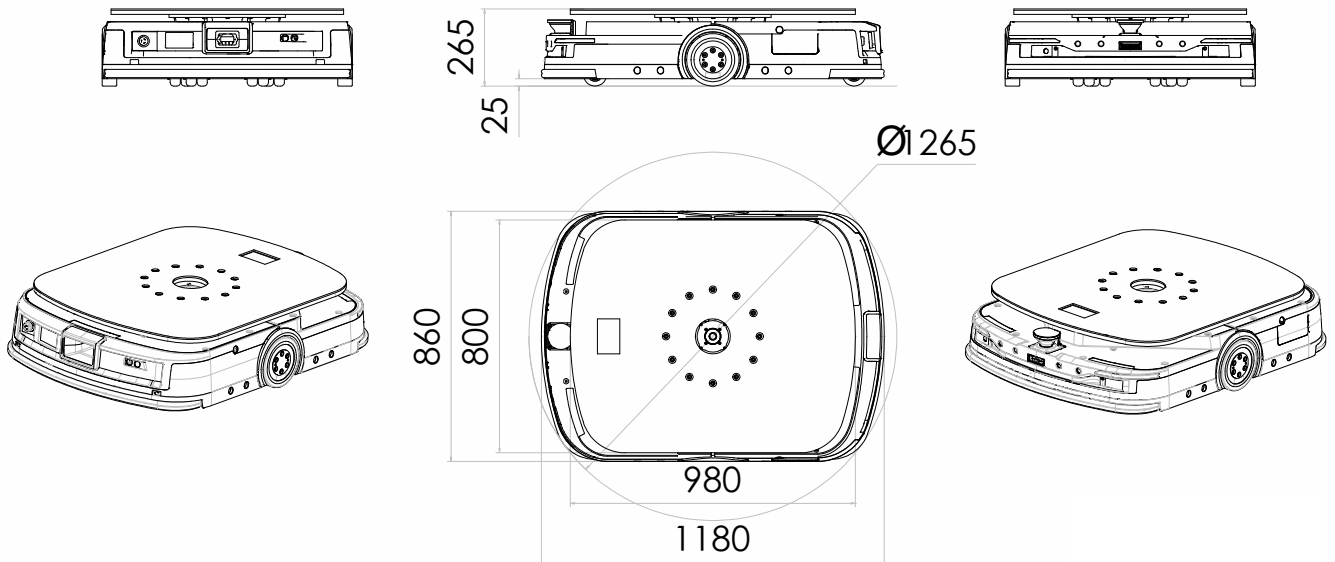
Specification

Model		MR-Q7-1000LE-DI(CE)
General Parameter	Dimensions L x W x H (mm)	1180*860*265
	Rotation diameter (mm)	1265
	Lifting height (mm)	60
	Chassis ground clearance (mm)	25
	Lifting table size (mm)	980*800
	Lifting motor	Electric
	Weight (kg)	247
	Rated load (kg)	1000
	Navigation	L-SLAM/QR code
	Display	Available

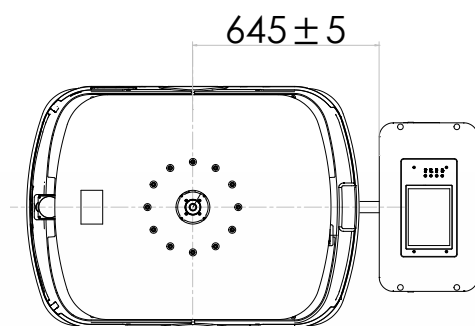


Safety Protection	Front laser height (mm)	195
	Front laser opening angle (°)	260
	Bumper strip	Front + Rear
	Emergency stop button	Front + Rear
	Sound alert	Available
Motion Performance	Rated operating speed (Empty load) (mm/s)	1800
	Rated operating speed (Rated load) (mm/s)	1500
	Rated acceleration (Empty load) (mm/s ²)	1000
	Rated acceleration (Rated load) (mm/s ²)	500
	Rotation speed (Empty load) (°/s)	180
	Rotation speed (Rated load) (°/s)	90
	Positioning angle accuracy (°)	±1
	Positioning angle accuracy (mm)	±10
Battery	Battery type	Lithium iron phosphate
	Rated voltage (V)	48
	Battery capacity (Ah)	44
	Charge cycle	1500 times (fully discharge & charge)
	Battery endurance (h)	8
	Charge time after fully discharge (h)	≤2

Dimension



Charge Station Position



Charging Station Model

CH-48/30B



1.4T
Rated Load
Capacity



1.3m/s
Max. Safety
Driving Speed



1600mm
Fork Lifting Height



2200mm
Min. Stacking
Aisle Width

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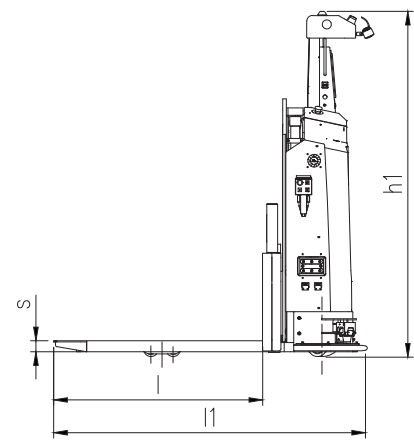
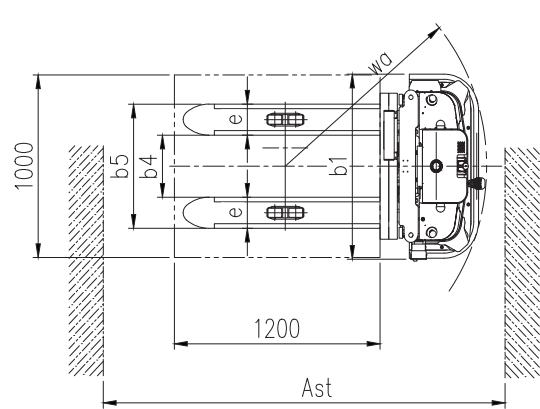
SLIM PALLET STACKER AGV



By using 3D SLAM navigation and 3D Laser perception module on narrow body pallet stacker AGV, the project implementation period is shortened and the AGV has high reliability; The AGV has narrow body design with customizable forks and supporting legs based on different scenarios, which provides great flexibility, and strong adaptability.



VNSL14(VL)-07



TECHNICAL SPECIFICATIONS

Body Weight	1000kg (2204.62lb)	Fork Lifting Height	1600mm (62.99in)
Vehicle Dimensions (l1/b1/h1)	1642x994x2150mm (64.65x39.13x84.65in)	Rated Load Capacity	1400kg (3086.47lb)
Fork Dimensions (l/e/s)	1150x180x60mm (45.28x7.09x2.36in)	Load Center Distance	600mm (23.62in)
Optional Fork Dimensions Series	1250/1350/1450mm (49.21/53.1/57.09in)	Min.Turning Radius	1173mm (46.18in)
Fork Outer Width	560/680mm (22.05/26.77in)	Locating Precision	±10mm/±0.5° (±0.39in/±0.5°)
Fork Inner Width	200/320mm (7.87/12.60in)	Operation Mode	Automatic / Manual Handheld
Positioning Method	3D SLAM navigation	Battery Type	Lithium iron phosphate
Perception Method	3D Laser scanner	Voltage/Battery Capacity	24V/180Ah
Goods Pick-up Self-adaptability	±100mm/±10° (±3.94in/±10°)	Charging Mode	Manual/ Automatic Charging

MOTION PERFORMANCE

Straight Forward Speed (Full-Load/Empty-Load)	1.0m/s, 1.3m/s (2.24mph, 2.91mph)	Backward Turning Speed (Full-Load/Empty-Load)	0.3m/s, 0.3m/s (0.67mph, 0.67mph)
Straight Backward Speed (Full-Load/Empty-Load)	0.3m/s, 0.3m/s (0.67mph, 0.67mph)	Lifting Up Speed (Full-Load/Empty-Load)	115mm/s, 175mm/s (0.26mph, 0.39mph)
Forward Turning Speed (Full-Load/Empty-Load)	0.3m/s, 0.6m/s (0.67mph, 1.34mph)	Lifting Down Speed (Full-Load/Empty-Load)	160mm/s, 125mm/s (0.36mph, 0.28mph)

ENVIRONMENTAL REQUIREMENT

Min. Stacking Aisle Width (Pallet Size L*W:1200*1000mm, Across Forks On Width)	2200mm (86.61in)	Ground Flatness	±5mm/m ² (±0.20in/m ²)
Min. Turning Aisle Width (Pallet Size L*W:1200*1000mm, Across Forks On Width)	1800mm (70.87in)	Max. Climbing Ability (Full-Load/Empty-load)	5%, 5% (3°, 3°)
Working Temperature	-5°C~40°C	Max. Groove Width	30mm (1.18in)
Working Humidity	20%~95%	Max. Step Height	10mm (0.39in)

SAFETY PROTECTION

Front	Laser Scanner Protection + Anti-Collision Bumper	Side	Laser Scanner Protection + Anti-Collision Bumper
Rear	Laser Scanner Protection + Non-Contact Sensor	Other	Emergency Stop Button + Acousto-Optic Alarm
Top	Photoelectric Sensor + Ultrasound Scanner		

* Customizable fork length, fork outer width, and supporting legs outer width; With duplex mast option, the lifting height can reach 1600mm, 2500mm, and 3000mm (body weight varies slightly with different mast selections); Other available options: 5G communication, battery heating, loads over height detection, UWB safety system, barcode scanner, dash camera, RFID reader, etc. Maximum load capacity varies with lifting height, please refer to load capacity curve. All the above parameters are obtained from the factory testing environment of standard products, and the vehicle parameters and performance of the project may vary according to actual conditions. Due to products upgrade, the specifications and parameters may be changed without notice. Please consult the sales for details.

NUEVA TECNOLOGIA MLC CON TOUCH SCREEN:

MULTI LEVEL CONTROL permite la partición del palet a enfardar en 9 niveles pudiendo aplicar una configuración adecuada a cada nivel. Las regulaciones posibles son:

- Tensión del film
- Preestiro (si dispone)
- Vueltas de refuerzo.
- Velocidad giro del brazo.
- Velocidad subida bobina.
- En caso de disponer de cordón si desea activarlo.

VENTAJAS QUE NOS APORTA MLC:

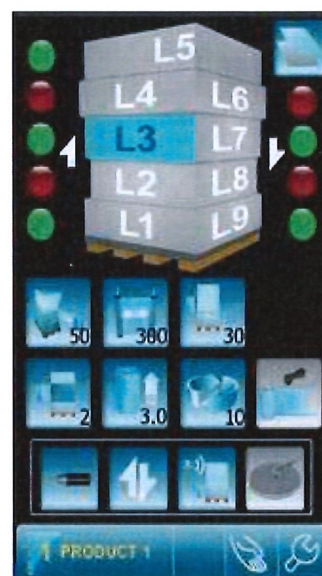
- Enfardado de cargas inestables o ligeras.
- Enfardado de cargas débiles sin deformarlas.
- Posibilidad de reforzar palets remontados en el punto de unión.
- Personalización de enfardado de cada palet consiguiendo ganar en productividad.
- Optimización consumo del film, para cada palet los gramos que sean necesarios.

CARACTERÍSTICAS FILM ESTIRABLE

- Film estirable LLDPE en bobinas.
- Espesor de 17 a 35 Micras
- Capacidad preestiraje versión PVS: 300-400 % según aplicación y tensión.
- Ancho bobina 500 mm
- Diámetro interno: 76 mm
- Diámetro externo máximo: 230 mm
- Peso máximo bobina: 20 kg

CARACTERÍSTICAS ELÉCTRICAS

- Protección implantación eléctrica IP 54.
- Protección motores eléctricos IP 54.
- Alimentación estándar 230 V. 1Ph+Neutro - 50/60Hz



MAQUINA CONFORME NORMATIVA CE - Directiva 2006/42/CE, 2004/108 CE.

DETALLE MÁQUINA



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integral
packaging
system

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VISIONNAV CONVEYOR DOCKING

Automate Your Intralogistics

Addressed to	Client & Partner Only
Supplier	VisionNav Robotics Limited (VisionNav)

General description

In this document, conveyor docking requirement is described for VisionNav AGV system. There are two main aspects to consider when involving conveyor docking:

Hardware

- Type of conveyors
- Space requirement
- Docking module selection

Software

- System architecture
- Protocol recommendation
- Information flow

1. Hardware

1.1 Type of conveyors

There are three main types of conveyors commonly integrated with VisionNav AGV system: roller conveyor, chain conveyor, and belt conveyor.

1.1.1 Roller conveyor

Roller Conveyor as shown in Picture 1.0 is suitable for various flat-bottomed goods such as boxes, bags, pallets, etc., but small items, bulk materials, or irregular-shaped items need to be placed on pallets or in boxes for transportation. It has strong weight capacity and can withstand significant impact loads.

1.1.2 Chain conveyor

Chain Conveyor as shown in Picture 1.1 uses a cyclically reciprocating chain as the driving force and metal plates as the conveying carrier. It generally has two forms: chain-type and plate-type. It can be used for single-row or multi-row transportation, and vice versa.

1.1.3 Belt conveyor

Belt Conveyor also known as a synchronous belt conveyor, it utilizes the continuous or harmonic motion between conveyor belts to transport different weight items. It can transport bulk materials as well as lightweight items such as cardboard boxes and packaging materials. It is widely used as shown in Picture 1.3.



Picture 1.0: Roller conveyor



Picture 1.1: Chain conveyor



Picture 1.3: Belt conveyor example

1.2 Space requirement

1.2.1 Front docking

1.2.1.1 AGV without supporting legs (E, P, R series)

When the loads are going to be picked up by AGV on the conveyor, the clearance between loads and conveyor sides need to be at least 30mm. The distance between load and the edge of the conveyor exit needs to be less than 20mm. If there is another pallet behind the one on the docking conveyor, the distance between the loads needs to be at least 100mm assuming the fork length is no longer than the load's length as shown in the Figure 1.4.

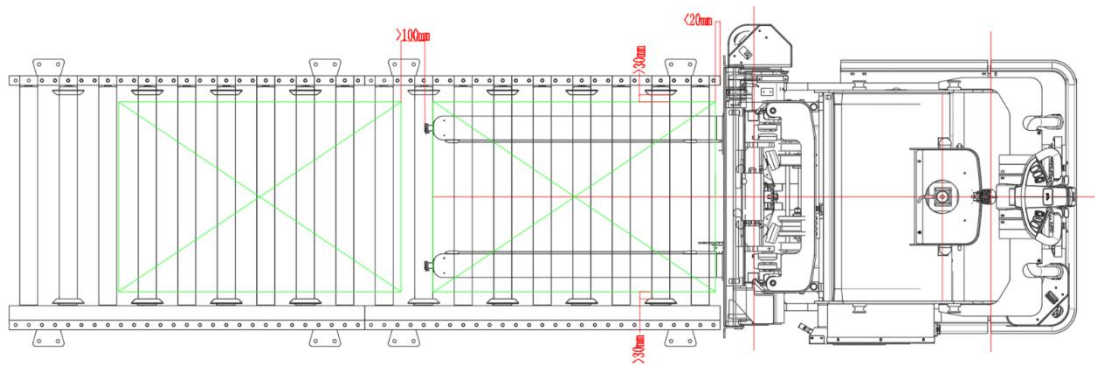


Figure 1.4: Conveyor front docking with AGV that has no supporting legs.

1.2.1.2 AGV with supporting legs (SLIM, L series)

When the AGV with supporting legs is front docking with conveyors, the space requirement underneath the conveyor is shown in Figure 1.5.

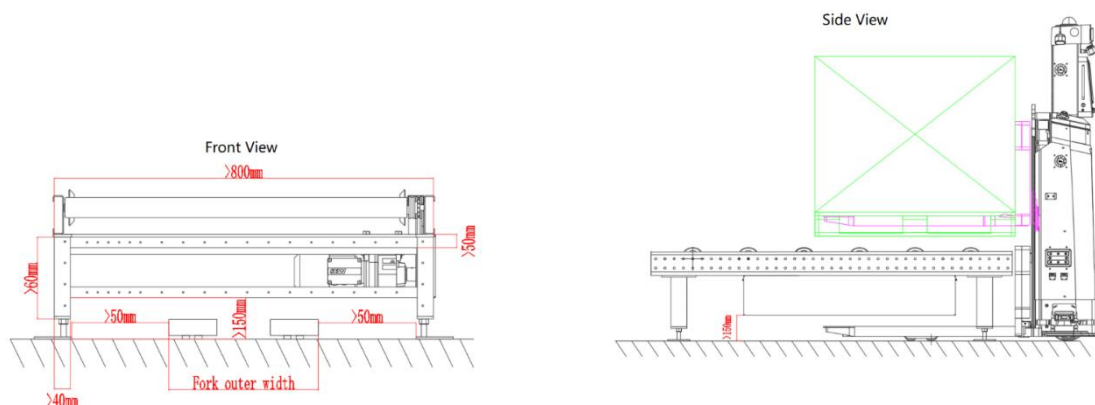


Figure 1.5: Conveyor front docking with AGV that has supporting legs.

1.2.2 Side docking

1.2.2.1 AGV without supporting legs (E, P, R series)

When the AGV without supporting legs is side docking with conveyors, the load needs to be as close as possible to the side of the conveyor as shown in Figure 1.6.

1.2.2.2 AGV with supporting legs (SLIM, L series)

When the AGV with supporting legs is side docking with conveyors, the space requirement underneath the conveyor is shown in Figure 1.7 and Figure 1.8.

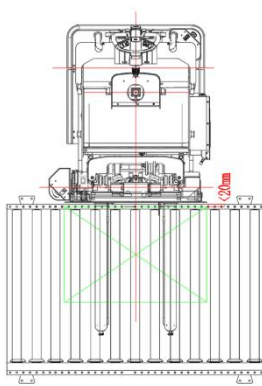


Figure 1.6

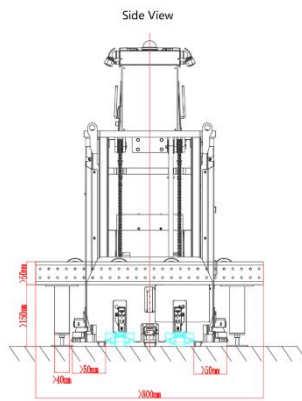


Figure 1.7

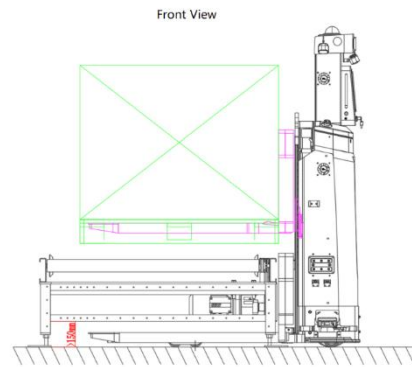


Figure 1.8

1.3 Docking module hardware architecture

1.3.1 Conveyor <-> WMS/MES/ERP <-> RCS

For conveyor docking with RCS via upper management system such as WMS, the customer's upper-level system manages cargo information, conveyor docking location status, conveyor status, and interacts with the RCS (Robot Control System) to issue commands.

In this scenario, no extra docking module hardware is needed.

1.3.2 Conveyor <-> RCS <-> WMS/MES/ERP

For conveyors docking with RCS directly, if the conveyor's PLC does not support the following protocol, an IoT module as shown in Figure 1.11 or PLC module with photoelectric sensors is recommended to use for conveyor docking:

- OPC-UA
- Modbus TCP
- S7
- TCP/IP

In Figure 1.10, the conveyor's PLC is communicated with RCS via IoT module or PLC module.

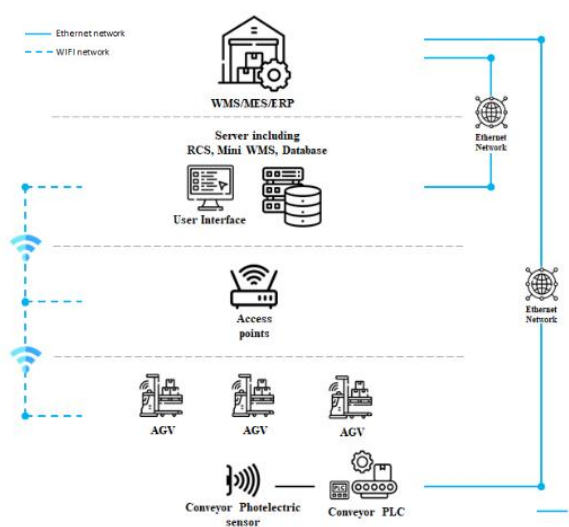


Figure 1.9

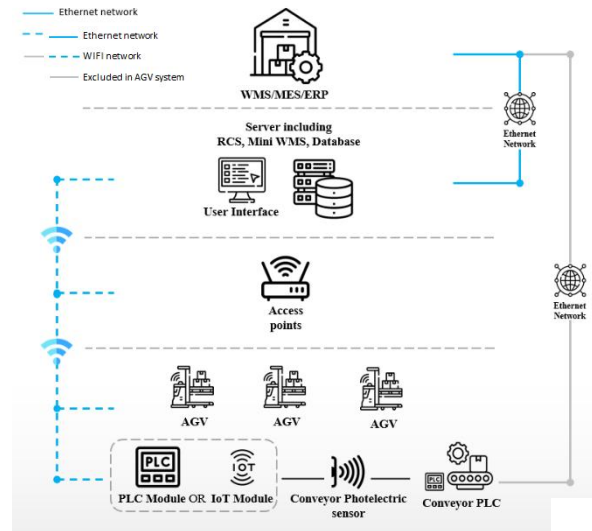


Figure 1.10

If the conveyor's PLC supports the following protocol, no extra docking hardware is needed for communication as shown in Figure 1.12.

- OPC-UA
- Modbus TCP
- S7
- TCP/IP

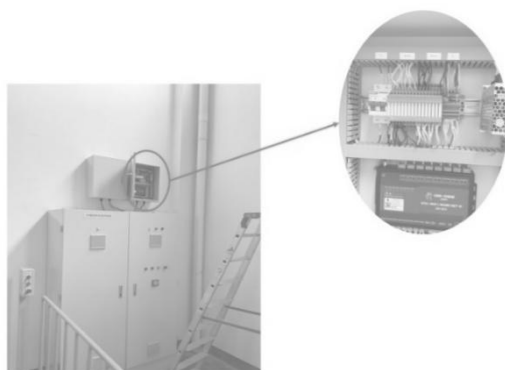


Figure 1.11: IoT module

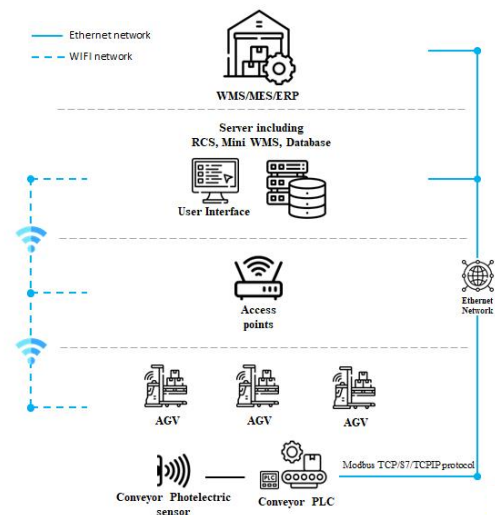


Figure 1.12: Conveyor docking with RCS

2. Software

2.1 Communication Protocol

VisionNav RCS can support communication protocol as following:

- Modbus TCP
- S7
- TCP/IP

For other communication protocols, please consult VisionNav technical department for further evaluation.

2.2 Information flow

2.2.1 Pick up procedure

No.	Name	Data Type	Interface Mode	Data Flow	RCS Read/Write
1	AGV request pickup	See communication protocols in detail	Communication	RCS→Conveyor line	R
2	Allowing AGV pickup		Communication	Conveyor line→RCS	W
3	AGV pickup completed		Communication	RCS→Conveyor line	R

2.2.2 Drop off Procedure

No.	Name	Data Type	Interface Mode	Data Flow	RCS Read/Write
1	AGV request pickup	See communication protocols in detail	Communication	RCS→Conveyor line	R
2	Allowing AGV pickup		Communication	Conveyor line→RCS	W
3	AGV pickup completed		Communication	RCS→Conveyor line	R

2.2.3 Conveyor Manual / Automatic mode

No.	Name	Data Type	Interface Mode	Data Flow
1	Conveyor manual mode	See communication protocols in detail	Communication	Conveyor line→RCS

2	Conveyor automatic mode		Communication	Conveyor line→RCS
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Version	Date	Description	Author
V1.0	2023/10/27	Initial version	ScottSu

Document history

* Please note that due to product upgrades, the specifications and parameters may be changed without prior notice. VisionNav assumes no responsibility for any resulting consequences from the changes. Please contact the sales team for the latest information.

Q:what is AMR aisle requirement ?

Table A.1 — Required zone classification and other requirements in areas with continuous fixed closed structures, considering clearances and personnel detection means

	Clearance between the truck and its load against the continuous fixed closed structure ^d		Clearance from the current position to the fixed closed structure/object in the direction of travel, C3	Personnel detection means in travel direction (PLd)	Max speed ^e	Required zone classification ^a	Reachable stop function required within 600 mm	Floor/ground marking or extra warnings required	Automatic restart permitted
	Clearance on one side, C1	Clearance on the other side, C2							
	mm	mm	mm						
1a	> 500	> 500	> 500	ACTIVE	Rated speed	Operating	NO	NO	YES
1b				MUTED	0,3 m/s	Operating hazard	NO	YES	— ^b
2a	> 500	> 500	< 500	ACTIVE ^f	0,7 m/s	Operating hazard	NO	YES	YES
2b				MUTED	0,3 m/s	Operating hazard	NO	YES	— ^b
3a	> 500	< 500 and > 100	> 500	ACTIVE	1,2 m/s	Operating hazard	NO	YES	YES
3b				MUTED	0,3 m/s	Operating hazard	NO	YES	— ^b
4a	> 500	< 500 and > 100	< 500	ACTIVE ^f	0,7 m/s	Operating hazard	NO	YES	YES
4b				MUTED	0,3 m/s	Operating hazard	NO	YES	— ^b

^a Table A.1 is not applicable to confined zones.

^b In these specific cases, automatic restart is permitted without personnel detection means if side clearance is > 500 mm on at least one side or clearance is > 500 mm from the current position to the fixed closed structure/object in the direction of travel.

^c Refer to 4.8.2.1 e) ii).

^d In cases where side clearance is less than 100 mm, the distance may be measured between the truck and load physical side and the continuous fixed closed structure or between the end of the bumper and the continuous fixed closed structure.

^e For increased speeds, see zone definitions.

^f Personnel detection means muting may apply according to 4.8.2.3.

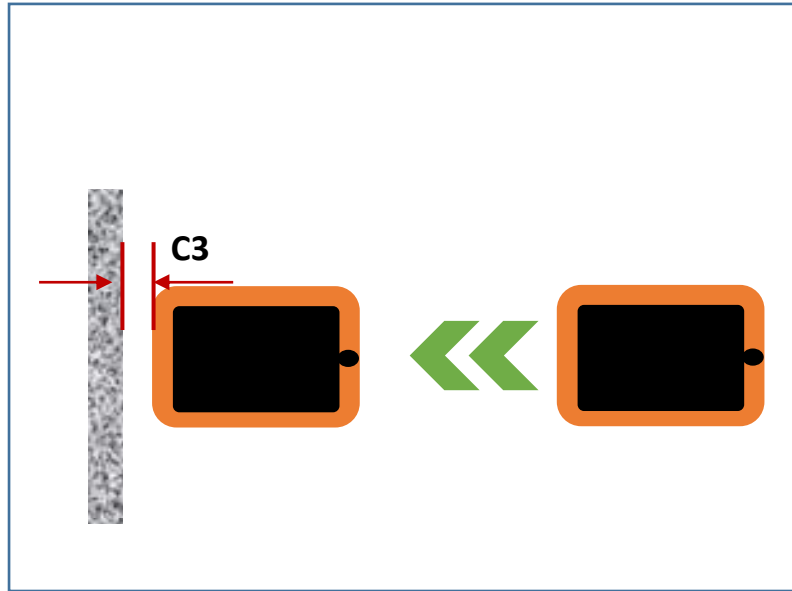
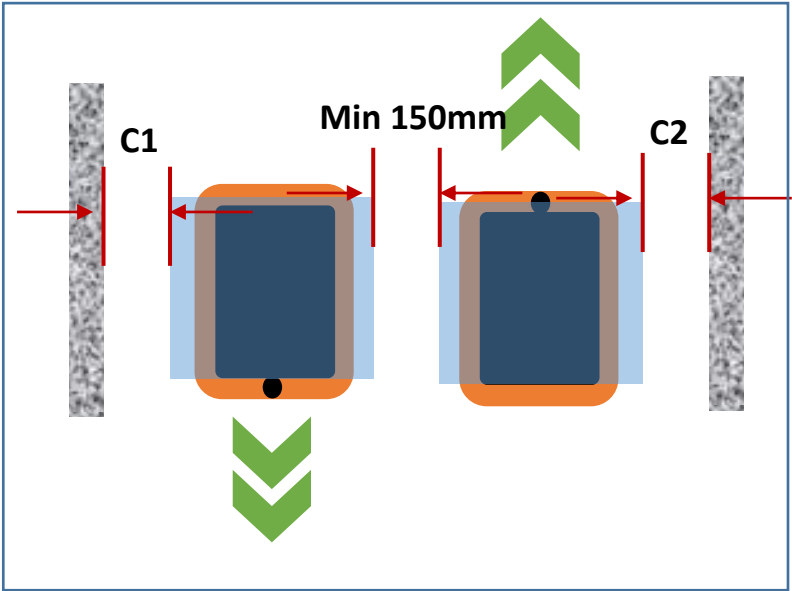
ISO 3691-4:2023(E)

Clearance between the truck and its load against the continuous fixed closed structure ^d		Clearance from the current position to the fixed closed structure/object in the direction of travel, C3	Personnel detection means in travel direction (PLd)	Max speed ^e	Required zone classification ^a	Reachable stop function required within 600 mm	Floor/ground marking or extra warnings required	Automatic restart permitted
5a	6a	7a	8a	9a				
5a	> 500	< 100	> 500	ACTIVE	Rated speed	Operating	NO	YES
				MUTED	0,3 m/s	Operating hazard	NO	— ^b
6a	> 500	< 100	< 500	ACTIVE ^f	0,7 m/s	Operating hazard	NO	YES
				MUTED	0,3 m/s	Operating hazard	NO	— ^b
7a	< 500 and > 100	< 500 and > 100	> 500	ACTIVE	1,2 m/s	Operating hazard	NO	YES
				MUTED	0,3 m/s	Restricted	NO	— ^b
8a	< 500 and > 100	< 500 and > 100	< 500	ACTIVE ^f	0,3 m/s	Operating hazard	YES ^c	YES
				MUTED	0,3 m/s	Restricted	YES ^c	NO
9a	< 500 and > 100	< 100	> 500	ACTIVE	1,2 m/s	Operating hazard	NO	YES
				MUTED	0,3 m/s	Restricted	NO	— ^b

^a Table A.1 is not applicable to confined zones.
^b In these specific cases, automatic restart is permitted without personnel detection means if side clearance is > 500 mm on at least one side or clearance is > 500 mm from the current position to the fixed closed structure/object in the direction of travel.
^c Refer to 4.8.2.1 d).
^d In cases where side clearance is less than 100 mm, the distance may be measured between the truck and load physical side and the continuous fixed closed structure or between the end of the bumper and the continuous fixed closed structure.
^e For increased speeds, see zone definitions.
^f Personnel detection means muting may apply according to 4.8.2.3.

Clearance between the truck and its load against the continuous fixed closed structure ^d	Clearance from the current position to the fixed closed structure/object in the direction of travel, C3	Personnel detection means in travel direction (PLd)	Max speed ^e	Required zone classification ^a	Reachable stop function or required warning within 600 mm	Floor/ground marking or extra warnings required	Automatic restart permitted		
Clearance on one side, C1	Clearance on the other side, C2								
mm	mm	mm							
10a	< 500 and > 100	< 100	< 500	ACTIVE ^f	0,3 m/s	Operating hazard	YES ^c	YES	NO
11a	< 100	< 100	> 500	MUTED	0,3 m/s	Restricted	YES ^c	YES	NO
11b				ACTIVE	Rated speed	Operating hazard	NO	YES	YES
12a	< 100	< 100	< 500	MUTED	0,3 m/s	Operating hazard	NO	YES	— ^b
12b				ACTIVE ^f	0,3 m/s	Operating hazard	YES ^c	YES	YES
				MUTED	0,3 m/s	Restricted	YES ^c	NO	

^a Table A.1 is not applicable to confined zones.
^b In these specific cases, automatic restart is permitted without personnel detection means if side clearance is > 500 mm on at least one side or clearance is > 500 mm from the current position to the fixed closed structure/object in the direction of travel.
^c Refer to 4.8.2.1 e) ii).
^d In cases where side clearance is less than 100 mm, the distance may be measured between the truck and load physical side and the continuous fixed closed structure or between the end of the bumper and the continuous fixed closed structure.
^e For increased speeds, see zone definitions.
^f Personnel detection means muting may apply according to 4.8.2.3.



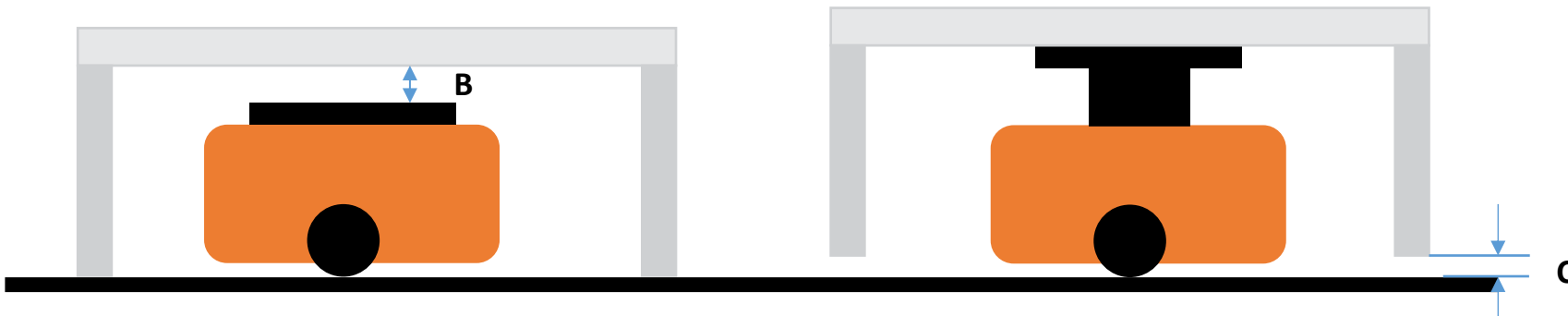
A: Based on ISO 3691-4, if gap between AMR and Wall(confined zone) is less than 500mm, the speed should be limited correspondingly

- ≥500mm is recommended gap
- Safety laser could be narrowed or muted when AMR traveling to confined zone, but less than 100mm(C1, C2, C3) is not proposed considering risk of collision

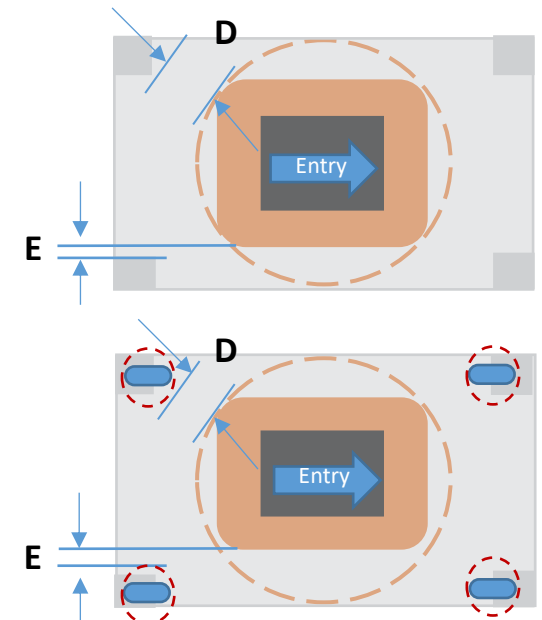
Q: Is there any requirement for AMR rack ?

A:

- The larger the contact surface between the shelf and AGV, the better
- Available position for 2d code in the center of bottom(function of 2d code :①Rack orientation identification.②Rack position correction. ③Module type info record and info transfer)
- $B \geq 25\text{mm}$ $C \geq 25\text{mm}$ for safety clearance
- $D \geq 40\text{mm}$ (If AMR route under rack independently needed)
- $E \geq 40\text{mm}$ for safety clearance



Side View



Top View

3. TABLAS DE CÁLCULOS

3.1. CÁLCULO DE AGVs DE PLATAFORMA DE HIK

3.2. CÁLCULO DE AGVs DE HORQUILLAS DE VISIONNAV

		PICKING ALMACEN			PICK-BUFFER	GES-BUFFER	REPOSICION	RESIDUOS
		FASE 1						
Route		FLUJO 1A	FLUJO 1B	FLUJO 1C	FLUJO 2	FLUJO 3	FLUJO 4	FLUJO 5
LMR running distance (m)		192	240	362	304	197	275	250
LMR running speed (m/s)		0,7	0,7	0,7	0,7	0,7	0,7	0,7
Round trip time (s)		411,4285714	514,2857143	775,7142857	651,4285714	422,1428571	589,2857143	535,7142857
LMR lift time (s)		3	3	3	3	3	3	3
Average lifting per task		2	2	2	2	2	2	2
Total lift time (s)		6	6	6	6	6	6	6
Rotation time (s)		3	3	3	3	3	3	3
Rotation per task		13	13	13	15	11	11	11
Total rotation time (s)		39	39	39	45	33	33	33
LMR Round trip time (s)		456,4285714	559,2857143	820,7142857	702,4285714	461,1428571	628,2857143	574,7142857
Docking time with Conveyor		60	60	60	60	85	25	0
Docking time with Elevator		0	0	0	0	0	0	0
LMR actual round trip time (s)		516,4285714	619,2857143	880,7142857	762,4285714	546,1428571	653,2857143	574,7142857
LMR handling efficiency (times/h)		7,0	5,8	4,1	4,7	6,6	5,5	6,3
Efficiency requirement (times/h)		21,6	13,4	13,0	33,0	30,0	5,0	1,0
Number of Robot (units)	21,1882	3,0986	2,3120	3,1706	6,9889	4,5512	0,9073	0,1596
Redundant coefficient		1,2	1,2	1,2	1,2	1,2	1,2	1,2
Total robot qty(unrounded)	25,4259	3,7	2,8	3,8	8,4	5,5	1,1	0,2
Total robot qty	29,0000	4,0	3,0	4,0	9,0	6,0	2,0	1,0
Total number of charge station	8,0000	1	1	1	2	1	1	1

AGV Calculation												Model	Pallet Stacker										
AGV Parameters																							
Max. speed (m/s)			Forward (m/s²)		Reverse (m/s²)		Turning (s)	Perception Time (s)	Forks Lifting Time (s)	Non-ground servo operation time (s)	Mast speed (mm/s)	Narrow aisle speed (m/s)		Efficiency									
With load	Empty load	Reverse	Acc.	Dec.	Acc.	Dec.	dia. 0.7m					Forward	Reverse										
1,3	1	0,3	0,4	0,5	0,4	0,5	3,5	10	10	10	125	0,3	0,3	100%									
Efficiency calculation																							
Process	Acc./Dec. counts with		Acc./Dec.		Reverse		Travel distance (m)			Narrow aisle distance (m)		Lifting height (mm)	Turnings	Load and unload counts	Equipment docking time (s)	Handling time (s/plt)	Congestion ratio (s) Rack & picking area (15%) Conveyor & AMR buffer (15%)	Auto charging time (s)1:3	Process total time (s)		Throughput (plt/h)	AGV #	
	Acc.	Dec.	Acc.	Dec.	Acc.	Dec.	With load	Empty load	Reverse	Forward	Reverse								Manually battery swap	Auto charging		Manually battery swap	Auto charging
Picking to wrapping machine	2	2	2	2	2	2	40	40	6	0	0	350	4	2	5	187,07	28,06	62,36	215,13	277,49	15,00	0,90	1,16
Picking to cage cust	5	5	3	3	2	2	53	53	6	0	0	350	8	2	0	230,09	34,51	76,70	264,61	341,31	5,00	0,37	0,47
WIP Pallets from Picking to racks	3	3	3	3	2	2	30	30	6	0	0	1750	6	2	0	198,95	29,84	66,32	228,79	295,11	12,00	0,76	0,98
WIP Pallets from racks to picking	3	3	3	3	2	2	30	30	6	0	0	1750	6	2	0	198,95	29,84	66,32	228,79	295,11	12,00	0,76	0,98
WIP cage from Picking to racks	3	3	3	3	2	2	30	30	6	0	0	1750	6	2	0	198,95	29,84	66,32	228,79	295,11	3,00	0,19	0,25
WIP cage from racks to picking	3	3	3	3	2	2	30	30	6	0	0	1750	6	2	0	198,95	29,84	66,32	228,79	295,11	3,00	0,19	0,25
Stacked empty pallets desk to rack	3	3	3	3	2	2	35	35	6	0	0	300	6	2	0	184,60	27,69	61,53	212,29	273,82	1,00	0,06	0,08
Single empty pallet to picking	2	2	2	2	2	2	15	15	6	0	0	1600	4	2	0	157,84	23,68	52,61	181,51	234,13	15,00	0,76	0,98
Empty cage desk to rack	3	3	3	3	2	2	35	35	6	0	0	1400	6	2	0	202,20	30,33	67,40	232,53	299,93	5,00	0,32	0,42
Empty cage from rack to picking	2	2	2	2	2	2	15	15	6	0	0	1750	4	2	0	160,24	24,04	53,41	184,27	237,69	5,00	0,26	0,33
Stacked empty pallets from conveyor in 4 to the docking desk	2	2	2	2	2	2	4	4	6	0	0	1123	4	2	5	139,02	20,85	46,34	159,87	206,21	1,00	0,04	0,06
Empty cage from conveyor in 4 to the docking desk	2	2	2	2	2	2	4	4	6	0	0	1123	4	2	5	139,02	20,85	46,34	159,87	206,21	5,00	0,22	0,29
Relocation from conveyor in 4 to AMR table	2	2	2	2	2	2	4	4	6	0	0	1123	4	2	5	139,02	20,85	46,34	159,87	206,21	16,00	0,71	0,92
Relocation from conveyor in 5 to AMR table	2	2	2	2	2	2	4	4	6	0	0	1123	4	2	5	139,02	20,85	46,34	159,87	206,21	14,00	0,62	0,80
Raw matrial from conveyor in 5 to AMR table	2	2	2	2	2	2	4	4	6	0	0	1123	4	2	5	139,02	20,85	46,34	159,87	206,21	8,00	0,36	0,46
Exotic load from AMR table to conveyor out 2	2	2	2	2	2	2	4	4	4	0	0	1123	4	2	5	132,35	0,00	44,12	132,35	176,47	6,00	0,22	0,29
Relocation from AMR table to conveyor out 2	2	2	2	2	2	2	4	4	4	0	0	1123	4	2	5	132,35	0,00	44,12	132,35	176,47	14,00	0,51	0,69
Relocation from AMR table to conveyor out 3	2	2	2	2	2	2	4	4	4	0	0	1123	4	2	5	132,35	0,00	44,12	132,35	176,47	14,00	0,51	0,69
Ceramics from AMR table to conveyor out 3	2	2	2	2	2	2	4	4	4	0	0	1123	4	2	5	132,35	0,00	44,12	132,35	176,47	6,00	0,22	0,29
Wrapping machine to conveyor Out 1	2	2	2	2	2	2	4	4	4	0	0	973	4	2	10	134,95	0,00	44,98	134,95	179,94	15,00	0,56	0,75
Cage cust to conveyor out 1	2	2	2	2	2	2	4	4	4	0	0	973	4	2	5	129,95	0,00	43,32	129,95	173,27	12,00	0,43	0,58
END																				SUM		8,98	11,70

Process total time = Efficiency * (acc. time with load * counts + acc. time w/o load * counts + reverse acc. time * counts + Forward time with load + Forward time w/o load + Reverse time + dec. time with load * counts + dec. time w/o load * counts + reverse dec. time * counts + Narrow aisle forward distance / speed + Narrow aisle backward distance / speed + turning time * counts + (Stopping time + Load or unload time + Auto adjustment modeling + Lifting height / Mast speed) * Load and unload counts) + Equipment docking time

4. DIAGRAMAS DE FLUJOS

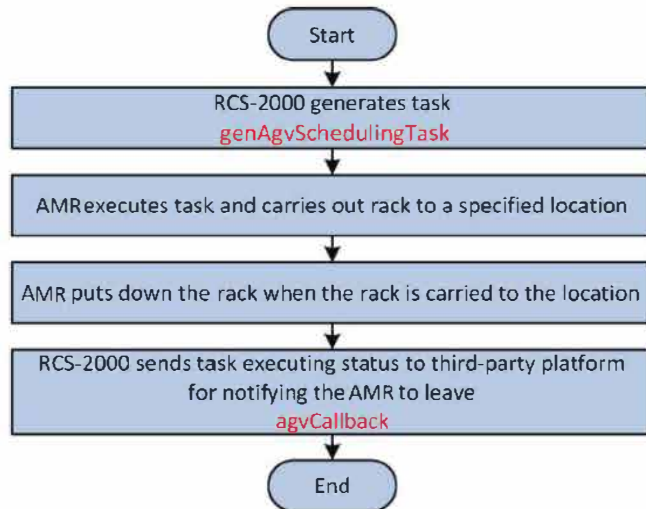
4.1. DIAGRAMA FUNCIONAMIENTO RCS HIK-GALYS

4.2. DIAGRAMA DE FLUJOS GALYS-RCS VISIONNAV

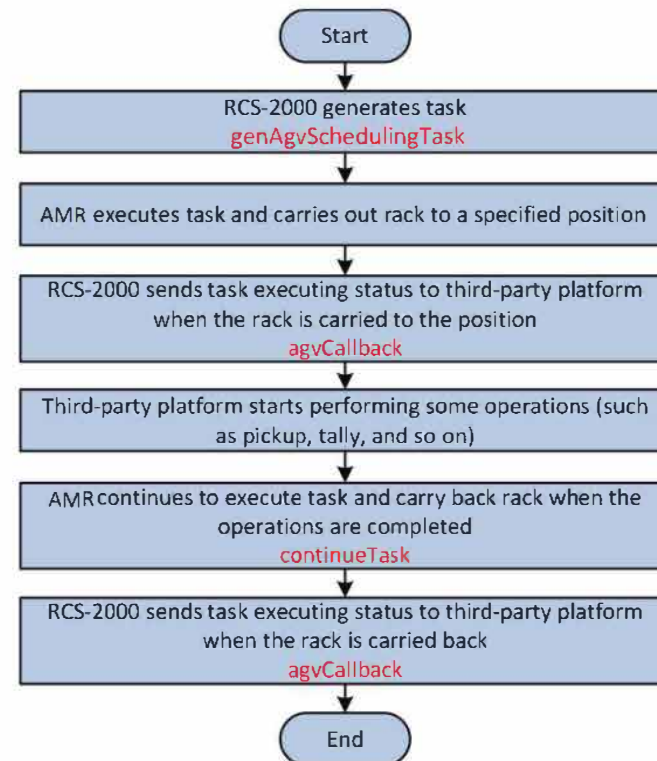
AMRs entreplanta. Flujos de comunicación



Recogida rack, depósito y salida en vacío



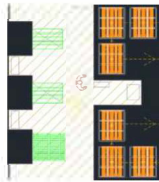
Recogida, depósito, espera y vuelta con rack



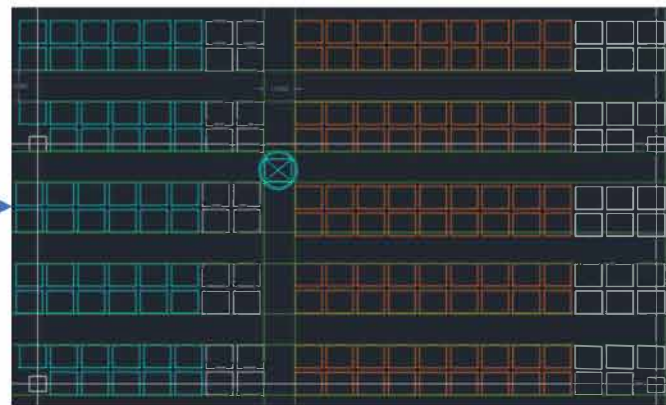
Flujos desde mesas a ubicación final



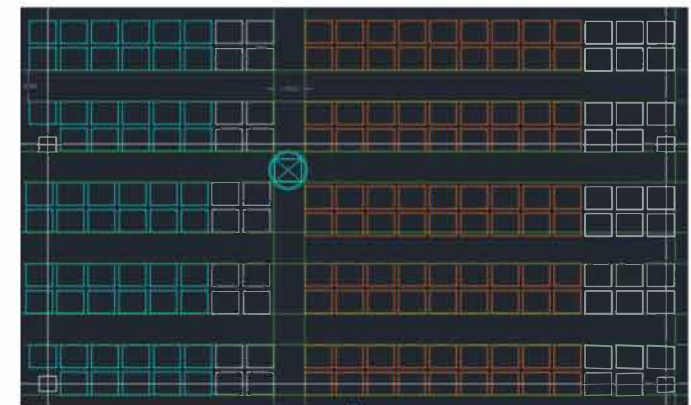
puestos de picking



ubicaciones picking referencias fijas



ubicaciones stock referencias fijas

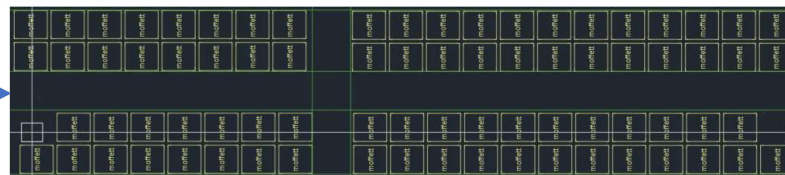


mesas vacías



mesas

ubicaciones picking referencias temporales



Destinos de HU desde buffer mesas:

- a)- ubicaciones picking referencias fijas*
- b)- ubicaciones stock referencias fijas*
- c)- ubicaciones picking referencias temporales*
- d)- puestos de picking*

Flujo de mesas a ubicación final



GALYS

AUTOCAR
RCS-2000

Post genAgvSchedulingTask ()

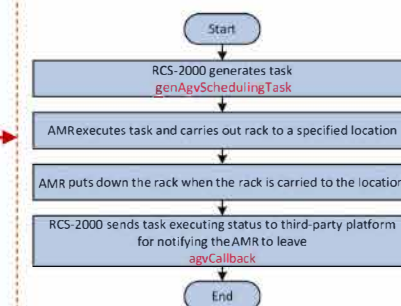
** Envía orden movimiento HU*
reqCode: 0000001234
taskTyp: F01 (carry and transfer rack)
wbCode: Ubi X mesas
positionCodePath: [{
positionCode: p01
type: 00
},
{
positionCode: x02
type: 02
}],
Priority: 1-127

** Aclarar forma de indicar los diferentes orígenes y destinos (¿Qué orden sigue?)*

** HU correctamente ubicada en su destino final*

Post AgvCallBack ()

reqCode: 0000001234
cooX: 3000
cooY: 21999 } *coordenadas de la ubicación*
currentPositionCode: p02 *ubicación*
mapCode: AA
mapDataCode: 002069AA015172 } *código del mapa y de la ubicación en él*
method: end *tarea completada*
podCode: 100001
robotCode: 6001
wbCode: p02

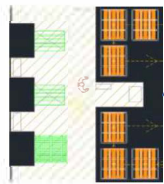


Destinos tipo:

- Stock refs. fijas
- Pick. refs. fijas
- Pick. refs. temp.
- Mesas vacías

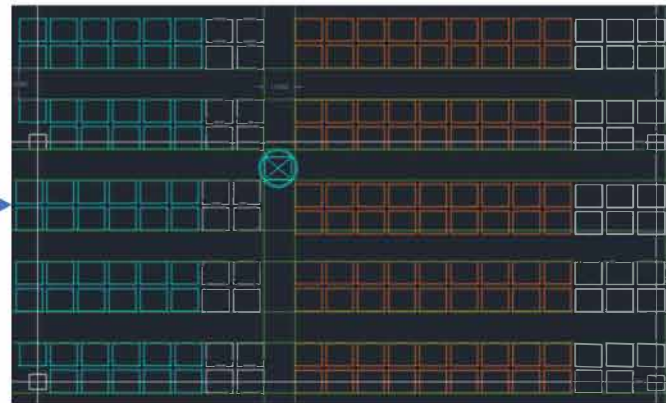
Flujos desde mesas a picking y después a ubicación final

puestos de picking



mesas

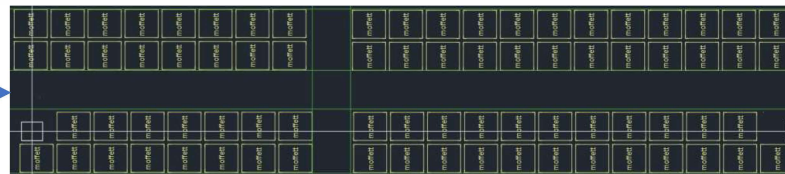
ubicaciones picking referencias fijas



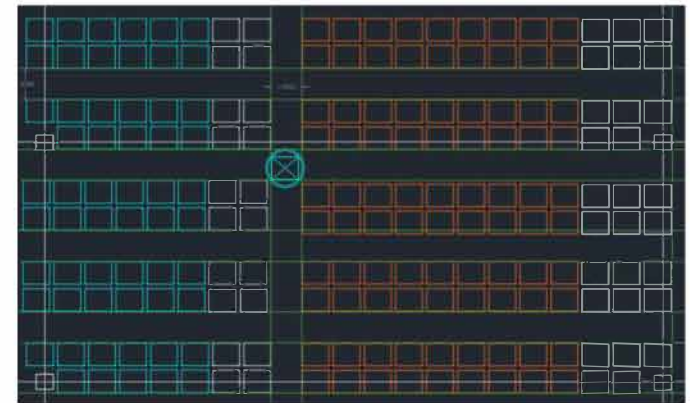
mesas vacías



ubicaciones picking referencias temporales



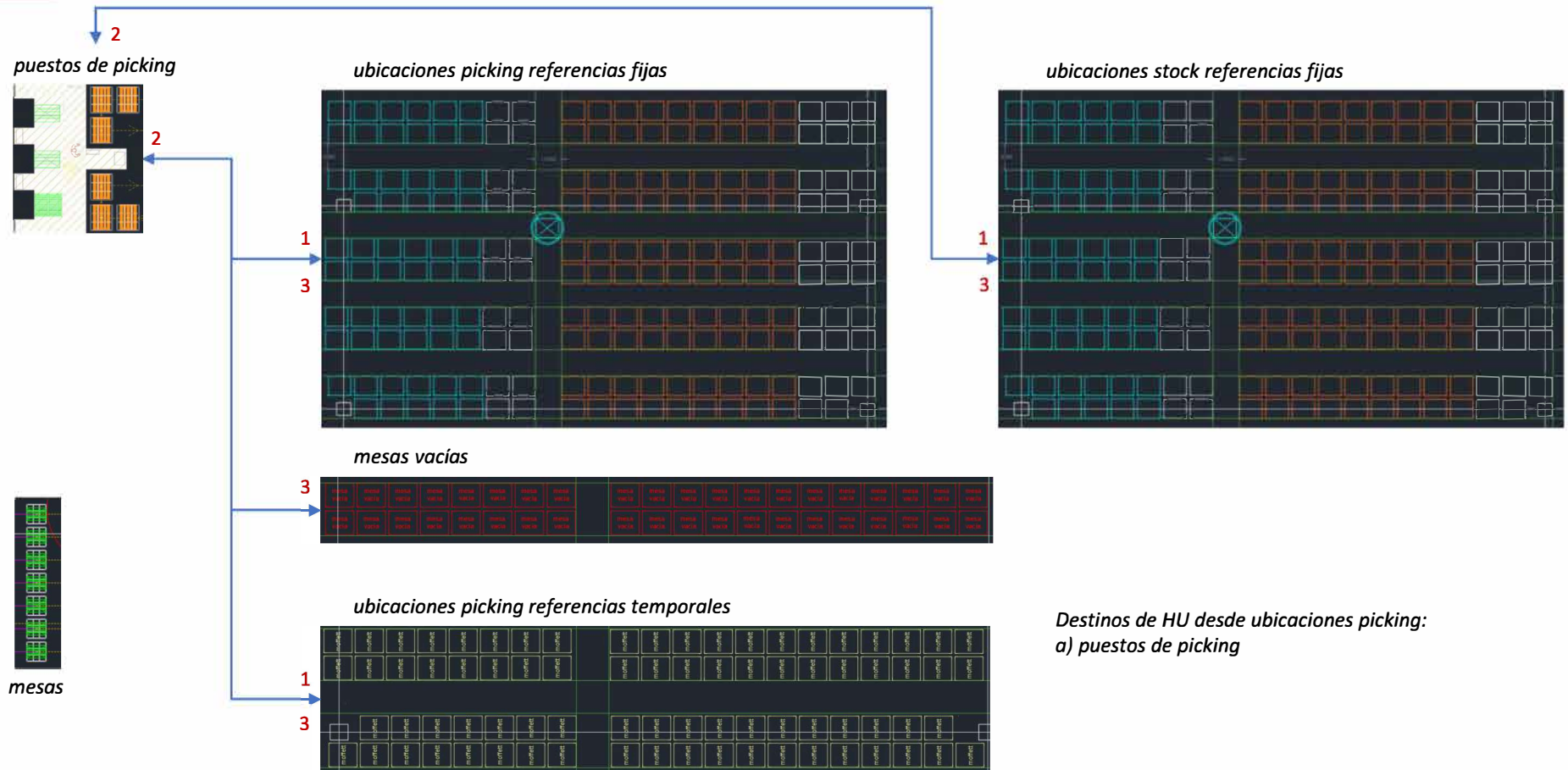
ubicaciones stock referencias fijas



Destinos de HU desde picking:

- a) puestos de picking
- b) ubicaciones picking referencias fijas
- c) mesas vacías
- d) puestos de picking

Flujos desde ubicaciones a picking y después a ubicación final



Flujo de mesas a puesto de picking y vuelta a ubicación final (I)

GALYS

Post genAgvSchedulingTask ()

** Envía orden movimiento HU*
reqCode: 0000001234
taskTyp: F01 (carry and transfer rack)
positionCodePath: [{
 positionCode: p01
 type: 00
],
 {
 positionCode: x02
 type: 02
 },
 {
 positionCode: n03
 type: 02
 },
],
priority: 1-127
taskCode: 123456

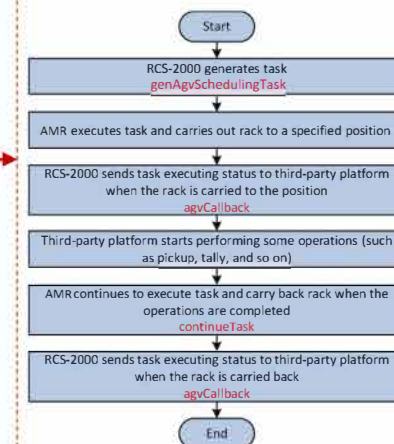
** Aclarar forma de indicar los diferentes origenes y destinos (¿Qué orden sigue?)*

** HU en puesto de picking*

Post AgvCallBack ()

reqCode: 0000001234
cooX: 3000
cooY: 21999 } *coordenadas de la ubicación*
currentPositionCode: x02 *ubicación*
mapCode: AA
mapDataCode: 002069AA015172 } *código del mapa y de la ubicación en él*
method: end *tarea completada*
podCode: 100001
robotCode: 6001
wbCode: x02

AUTOCAR
 ■ IK RCS-2000



Podría haber una secuencia de n posiciones de picking en las diferentes estaciones (solo 1 en este ejemplo)

Flujo de mesas a puesto de picking y vuelta a ubicación final (II)



GALYS

Post ContinueTask ()

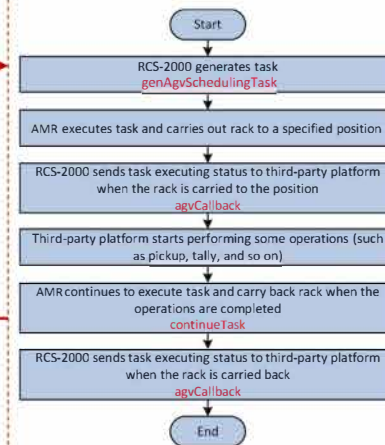
** Envía orden continuar con movimiento HU*
reqCode: 0000001234
taskCode: 123456
nextPositionCode {
positionCode: n03
type: 00
}

** HU en ubicación final*

AUTOCAR
MIK RCS-2000

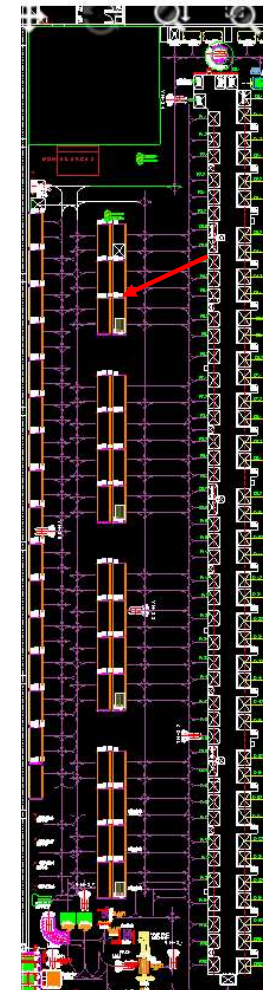
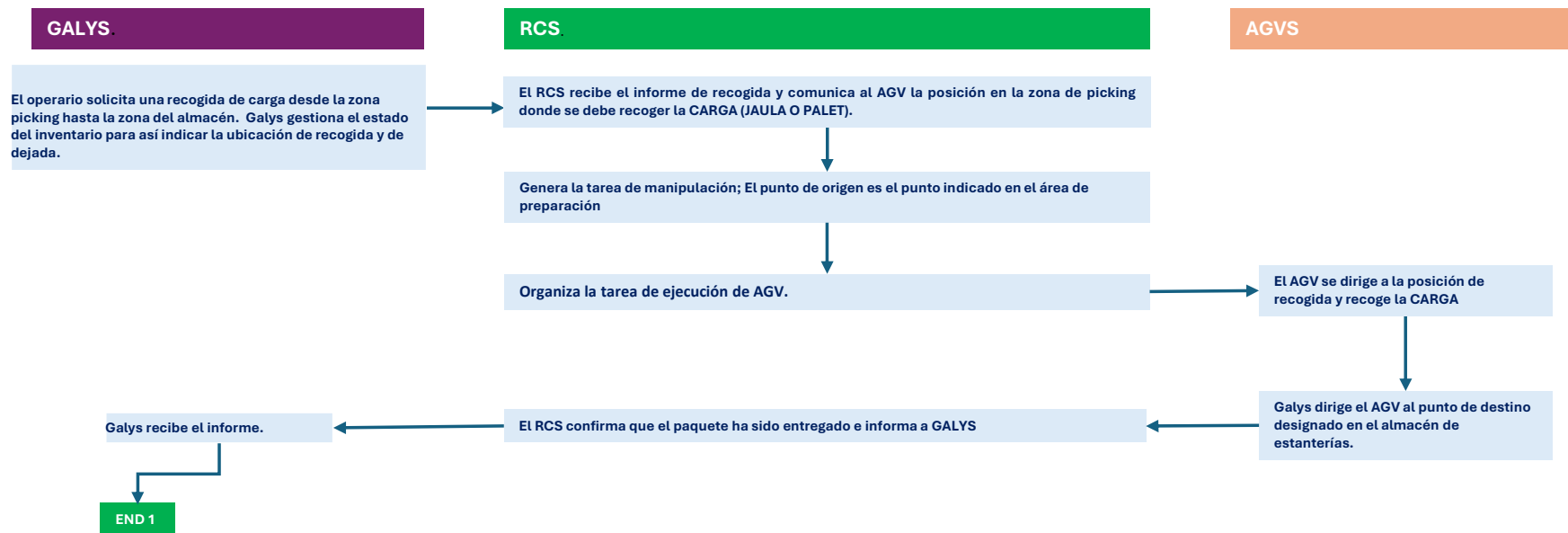
Post AgvCallBack ()

reqCode: 0000001234
cooX: 21315
cooY: 12551 } *coordenadas de la ubicación*
currentPositionCode: n03 *ubicación*
mapCode: AA
mapDataCode: 002012AA015415 } *código del mapa y de la ubicación en él*
method: end *tarea completada*
podCode: 100001
robotCode: 6001
wbCode: p02

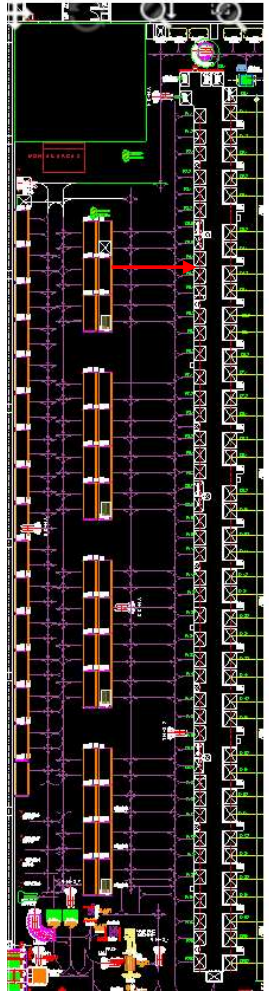
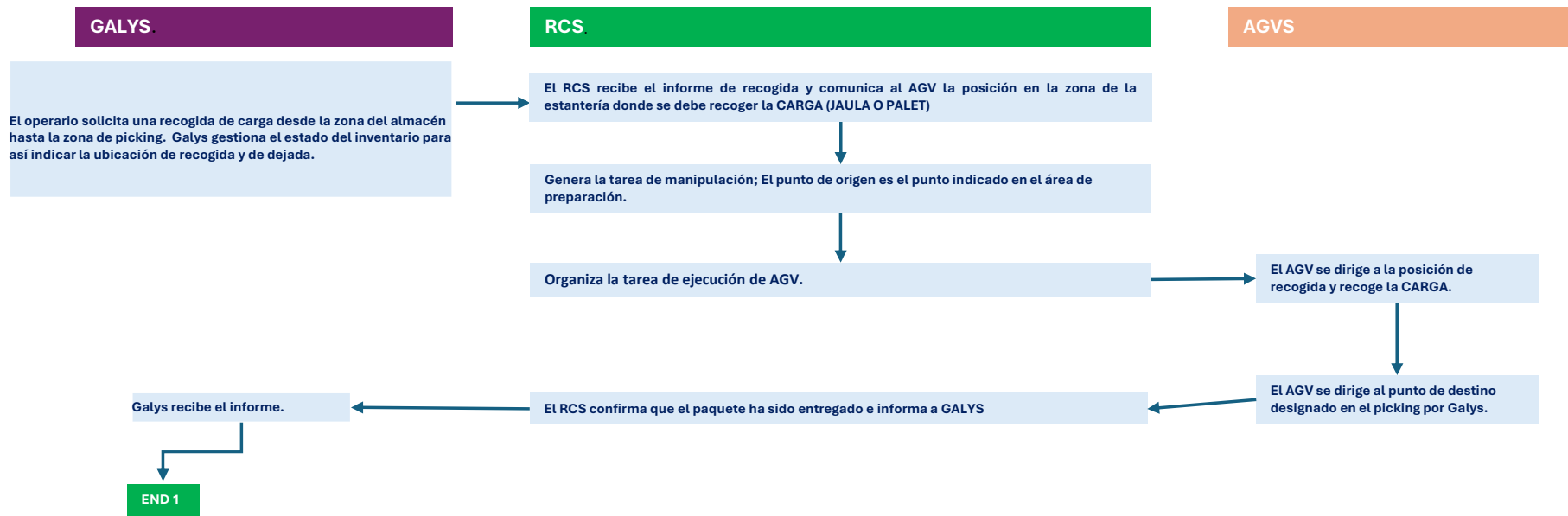


Podría haber una secuencia de n posiciones de picking en las diferentes estaciones (solo 1 en este ejemplo)

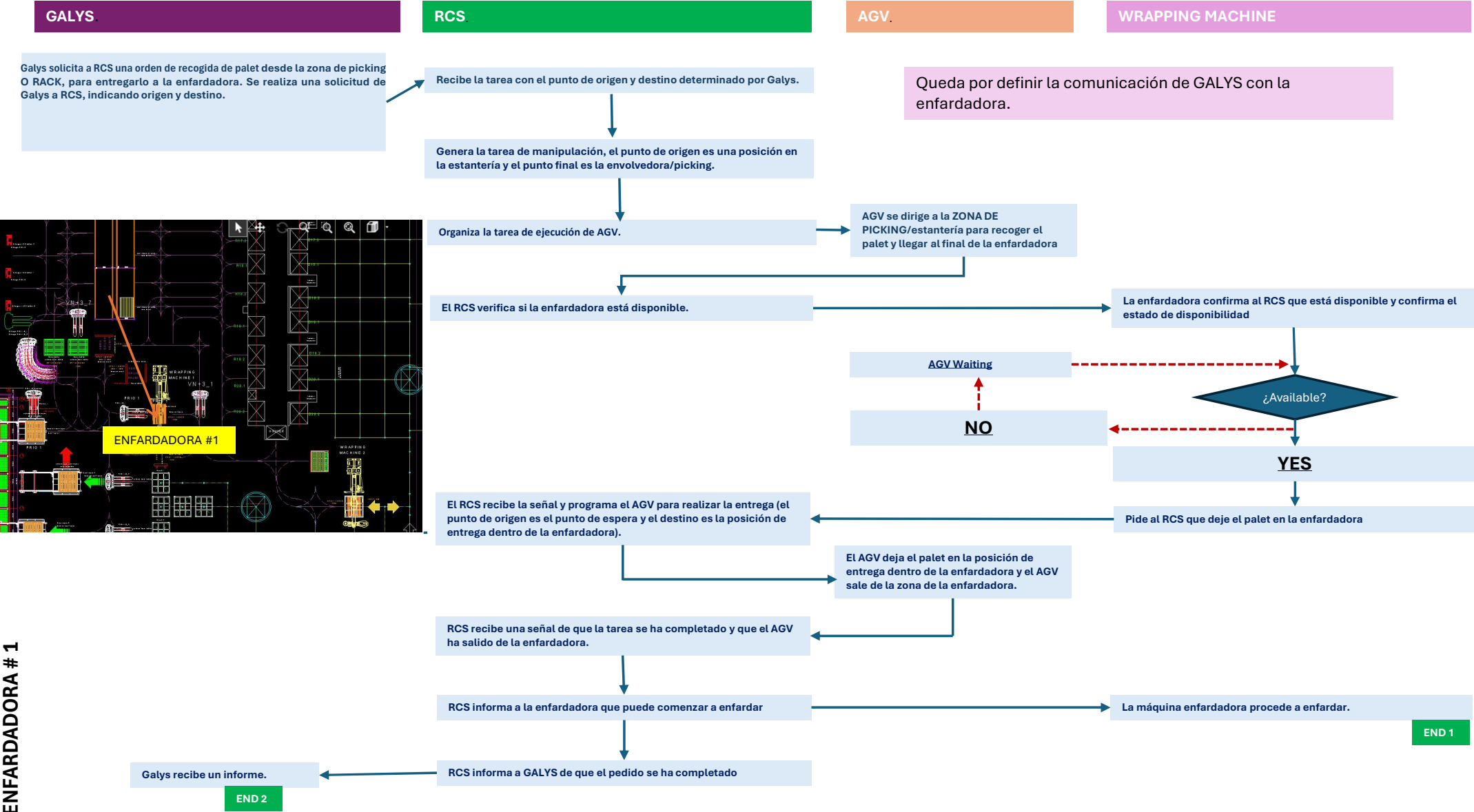
PROCESO 1.1 PALETO O JAULAS DESDE EL ÁREA DE PICKING HASTA EL ALMACÉN DE ESTANTERÍAS



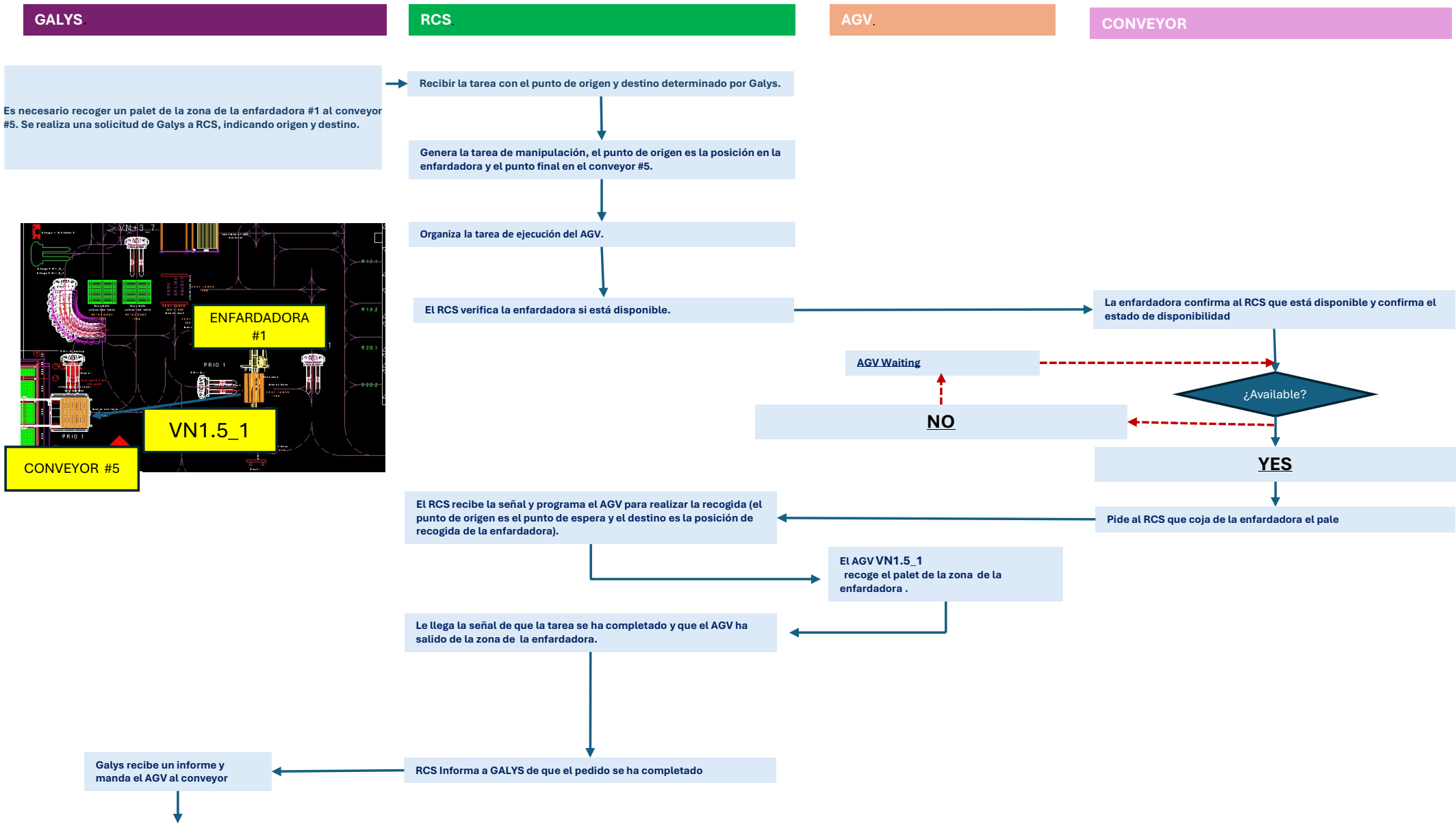
PROCESO 1.2 PALET O JAULAS DESDE EL ÁREA DE EL ALMACÉN DE ESTANTERÍAS HASTA EL PICKING



PROCESO 2.1 PALET TERMINADO DESDE EL ÁREA DE PICKING O ESTANTERÍA HASTA LA ENFARDADORA #1



PROCESO 2.2.2 PALET TERMINADO DESDE LA ENFARDADORA #1 HASTA EL CONVEYOR #5



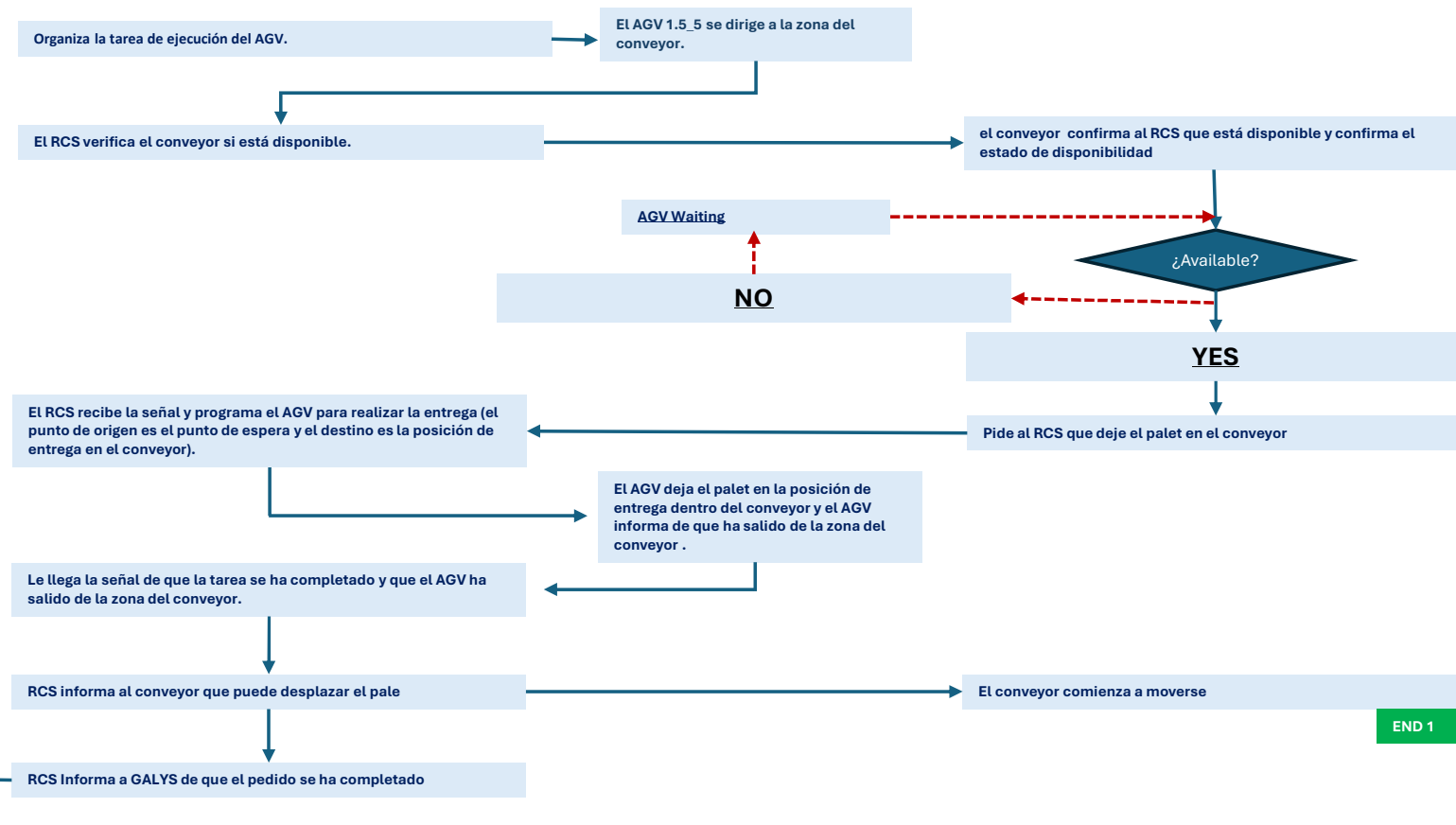
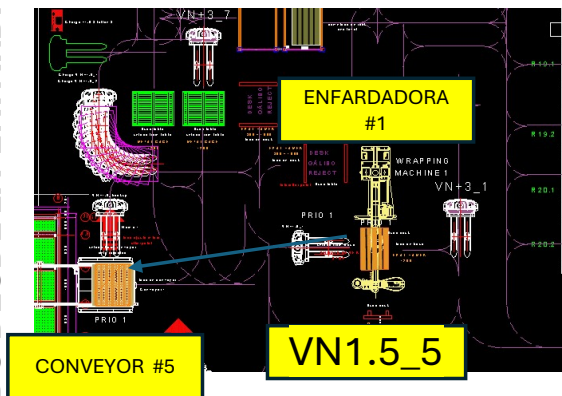
PROCESO 2.2 PALET TERMINADO DESDE LA ENFARDADORA #1
HASTA EL CONVEYOR #5

GALYS.

RCS.

AGV.

CONVEYOR



PROCESO 3.1 PALET TERMINADO DESDE EL ÁREA DE ESTANTERÍA/PICKING HASTA LA ENFARDAORA #2

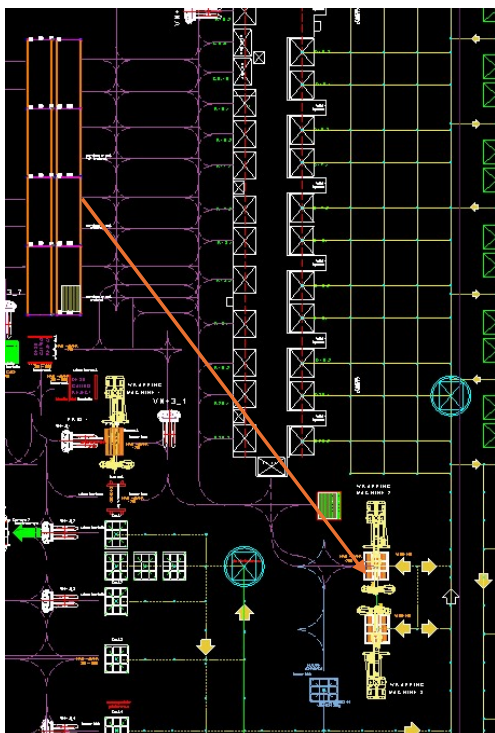
GALYS

RCS

AGV

WRAPPING MACHINE

En el caso de que tengamos un problema en la primera enfardadora o el flujo exceda de los 15 movimientos a la hora, es necesario recoger un palet de la zona de picking O RACK, para entregarlo a la enfardadora #2. El supervisor realiza una solicitud para funcionar con dos enfardadoras o solamente con la segunda. Galys crea una orden a RCS, indicando origen y destino.



Recibir la tarea con el punto de origen y destino determinado por Galys.

Genera la tarea de manipulación, el punto de origen es una posición en la plataforma de picking o estantería y el punto final es la enfardadora.

Organiza la tarea de ejecución del AGV.

AGV se dirige a la ZONA DE PICKING/estantería para recoger el palet y llegar al final de la enfardadora #2

El RCS verifica con la enfardadora si está disponible.

La máquina enfardadora confirma al RCS que está disponible y confirma el estado de disponibilidad.

AGV Waiting

NO

¿Available?

YES

El RCS recibe la señal y programa el AGV para realizar la entrega (el punto de origen es el punto de espera y el destino es la posición de entrega dentro de la enfardadora.

Pida al RCS que deje el palet en la envolvedora

El AGV deja el palet en la posición de entrega dentro de la enfardadora y el AGV sale de la zona de la enfardadora.

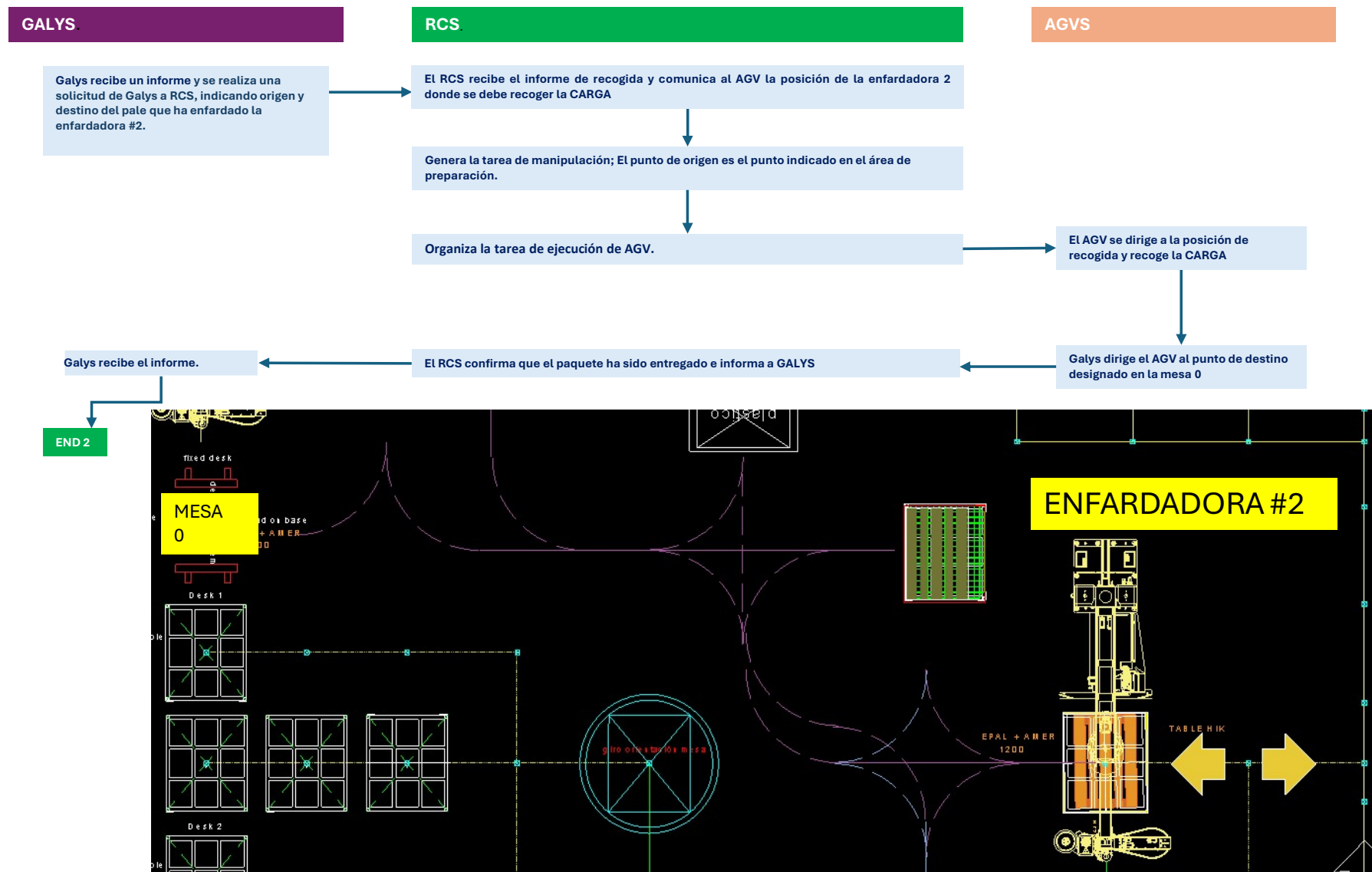
Le llega la señal de que la tarea se ha completado y que el AGV ha salido de la enfardadora.

RCS informa a la enfardadora que puede comenzar a enfardar

La máquina enfardadora procede con la envoltura y avisa cuando ha acabado de enfardar.

RCS Informa a GALYS de que el pedido se ha completado y que está preparado para recoger .

END 1



GALYS.

RCS.

AGV.

CONVEYOR

Es necesario recoger un palet de mesa 0 al conveyor. Se realiza una solicitud de Galys a RCS, indicando origen y destino.

Recibir la tarea con el punto de origen y destino determinado por Galys.

Genera la tarea de manipulación, el punto de origen es la posición en la enfundadora y el punto final en el conveyor #5.

Organiza la tarea de ejecución de AGV.

El AGV VN 1.5_2 se dirige a la mesa 0 para luego ir al conveyor #4.

El RCS verifica que el conveyor está disponible.

el conveyor confirma al RCS que está disponible y confirma el estado de disponibilidad

AGV Waiting

NO

¿Available?

YES

Pide al RCS que deje el palet en el conveyor

El RCS recibe la señal y programa el AGV para realizar la entrega (el punto de origen es el punto de espera y el destino es la posición de entrega en el conveyor).

El AGV deja el palet en la posición de entrega dentro del conveyor y el AGV informa de que ha salido de la zona del conveyor .

Le llega la señal de que la tarea se ha completado y que el AGV ha salido de la zona del conveyor.

RCS informa al conveyor que puede desplazar el pale

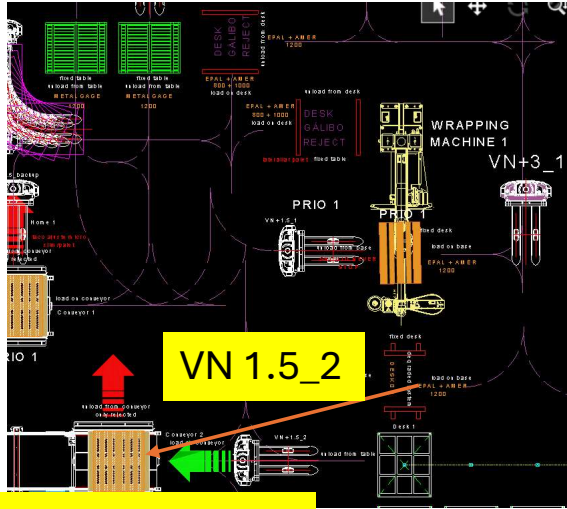
El conveyor comienza a moverse

END 1

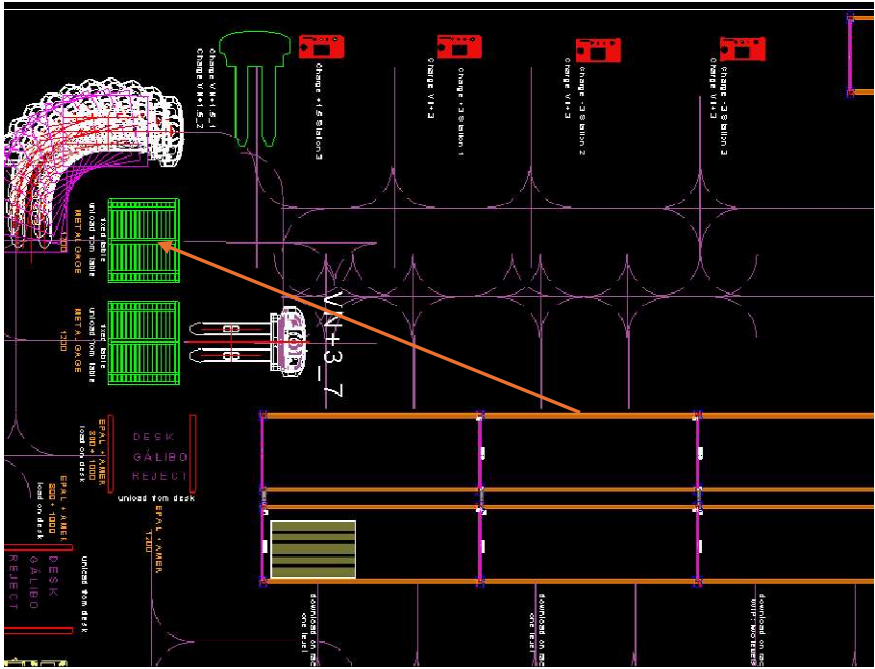
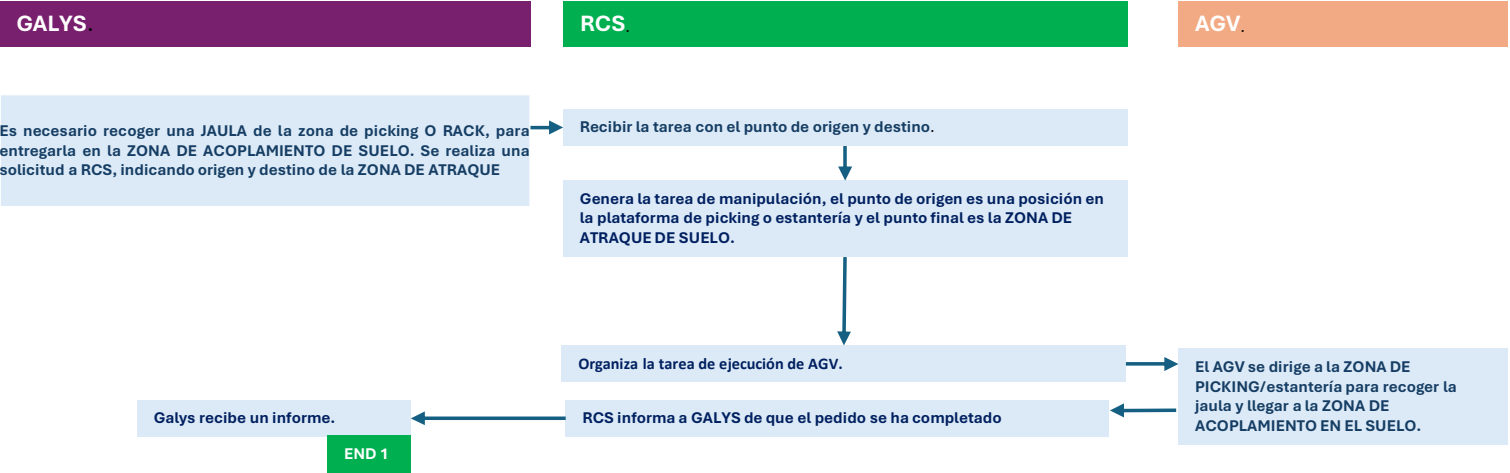
Galys recibe un informe.

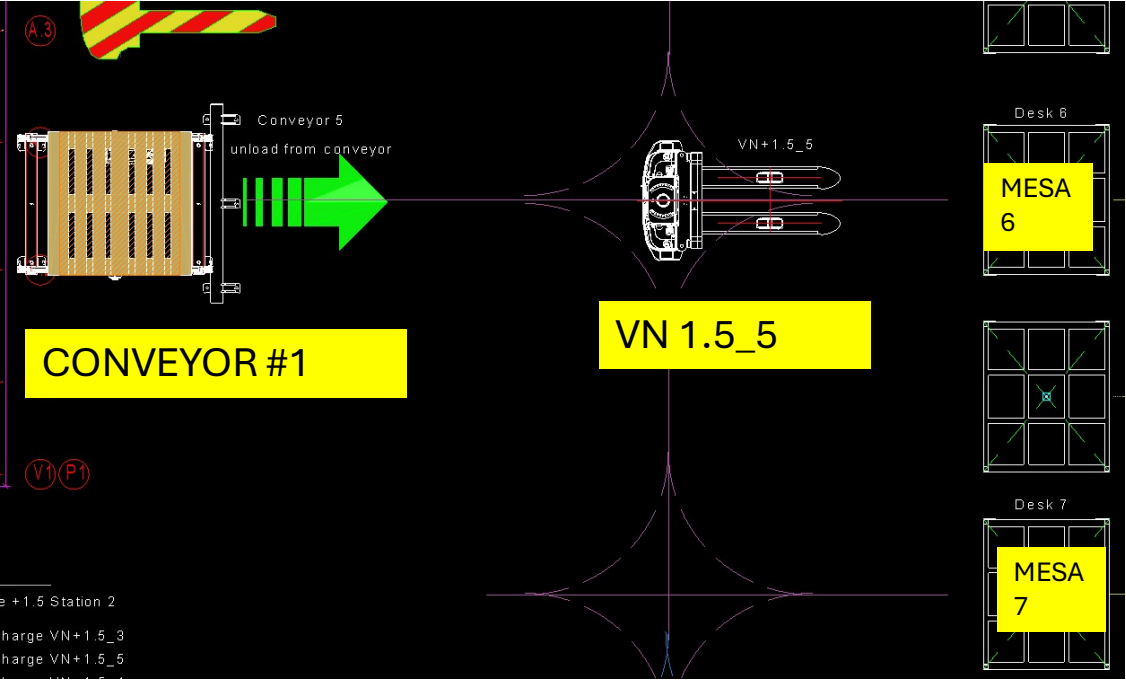
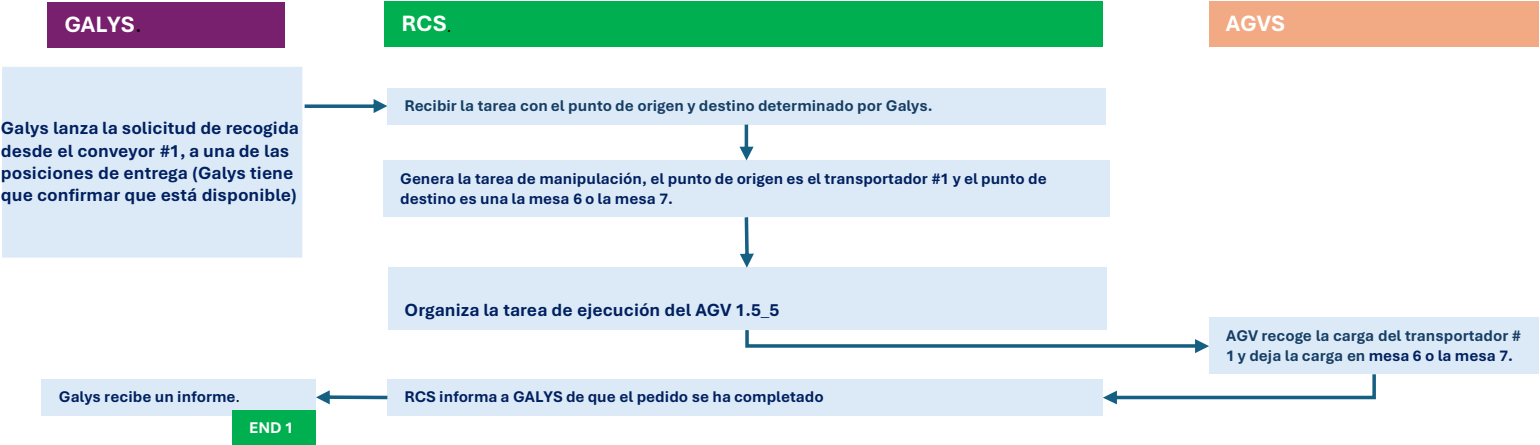
END 2

RCS informa a GALYS de que el pedido se ha completado

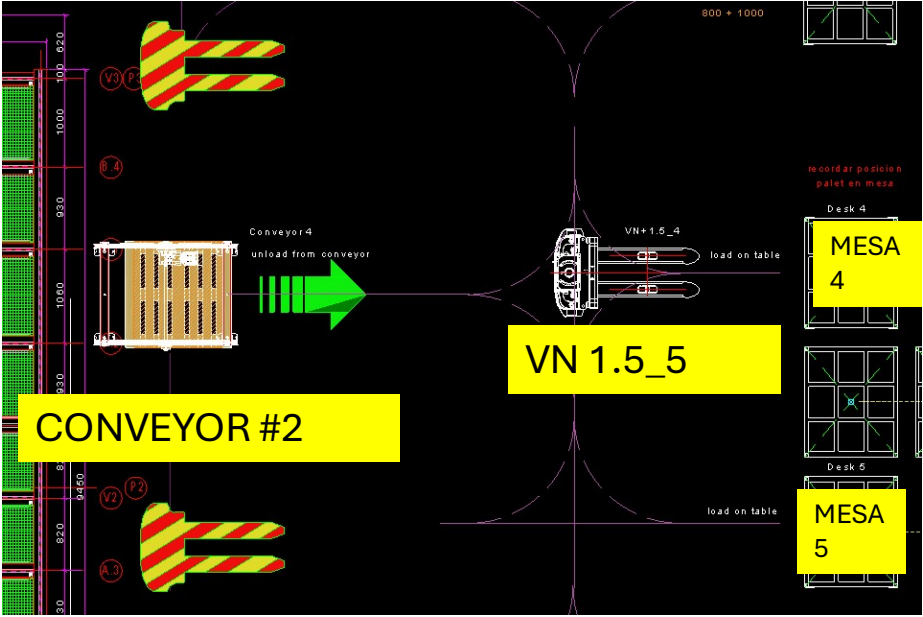
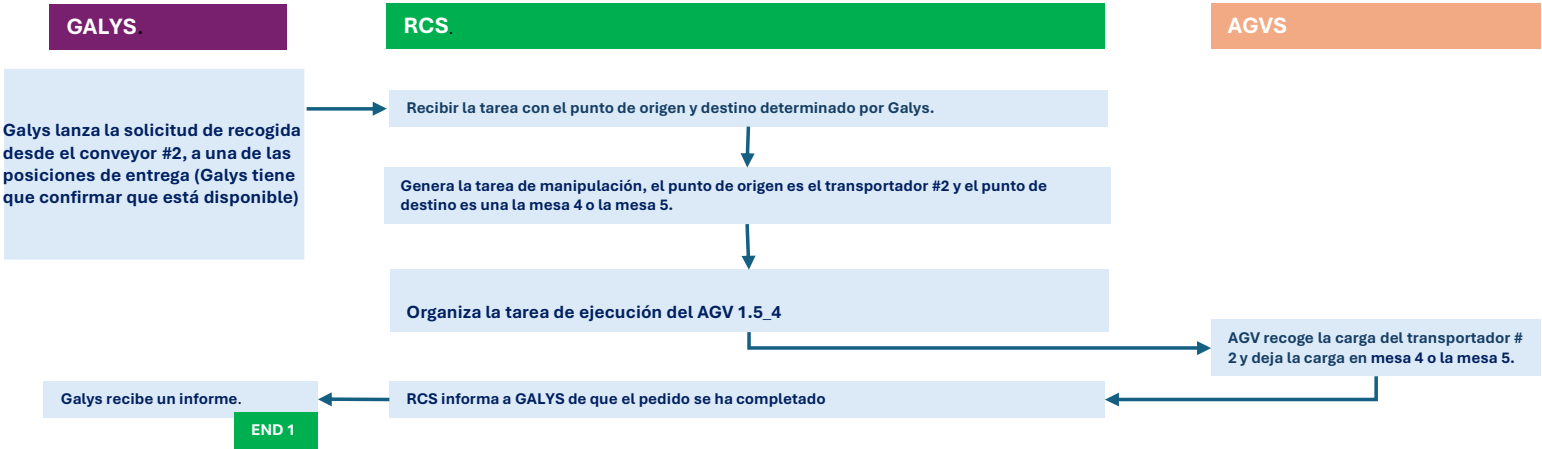


PROCESO 4 JAULA TERMINADA DESDE EL ÁREA DE RECOLECCIÓN O ESTANTERÍA HASTA LA POSICIÓN DE RECOGIDA EN EL SUELO.

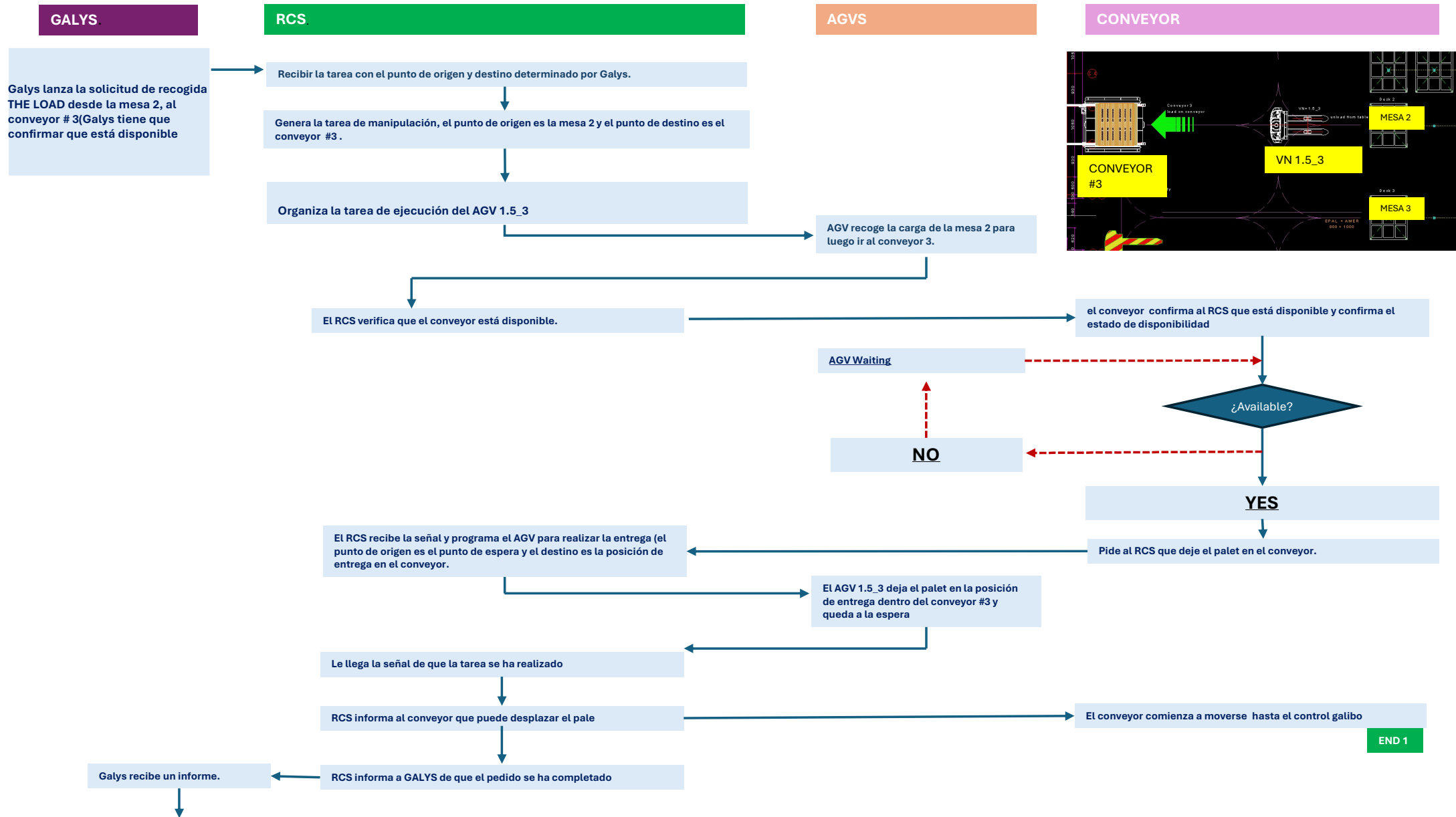




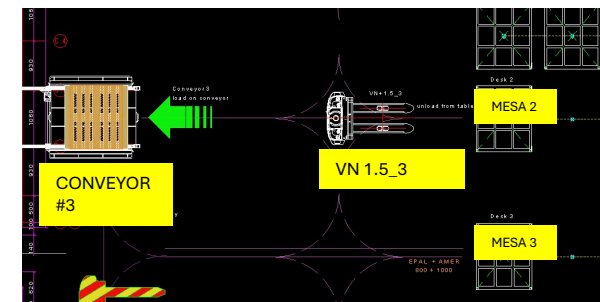
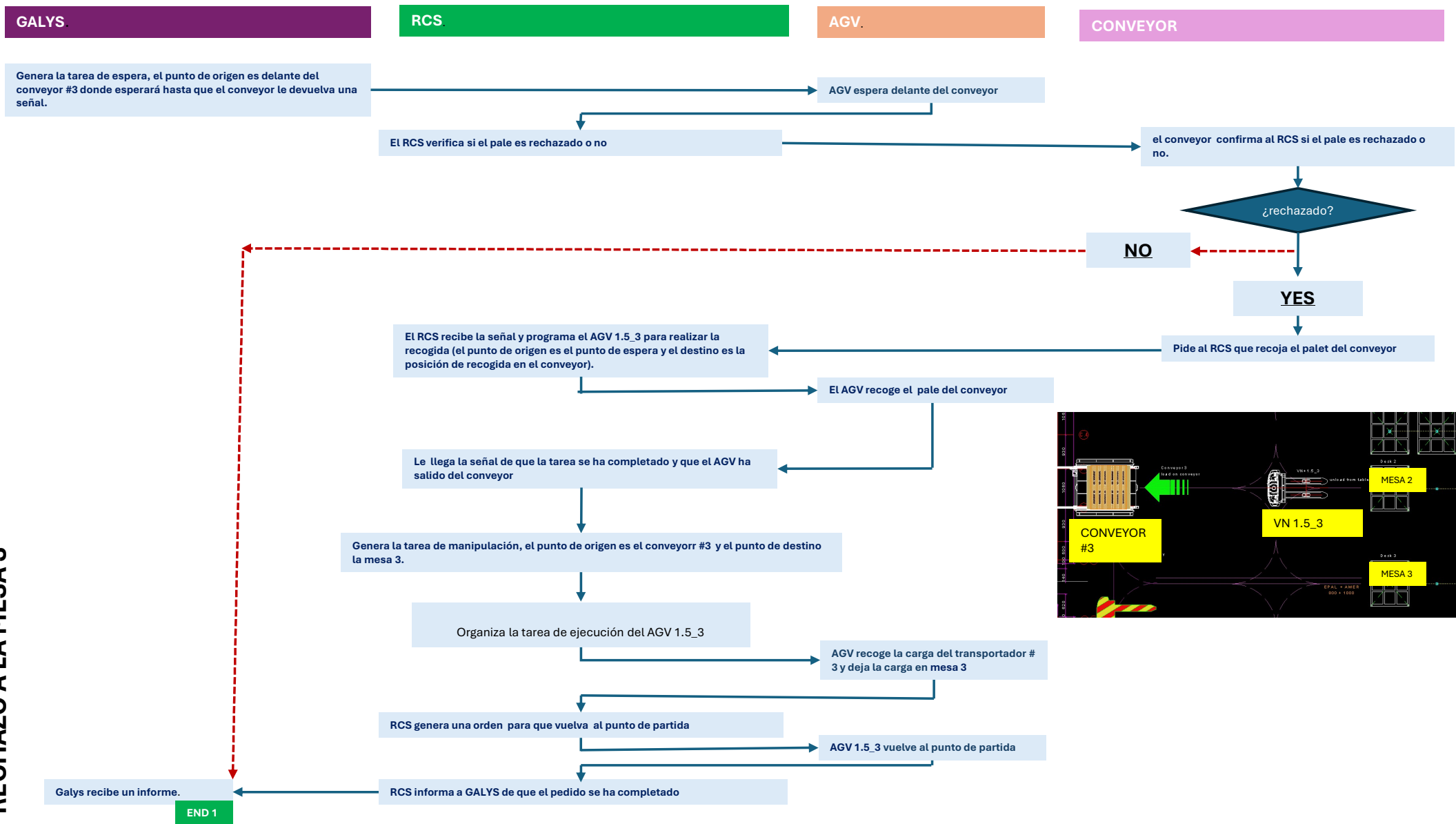
PROCESO 6 RECOGIDA DE PALET DESDE EL CONVEYOR #2 HASTA LAS MESAS 4 Y 5

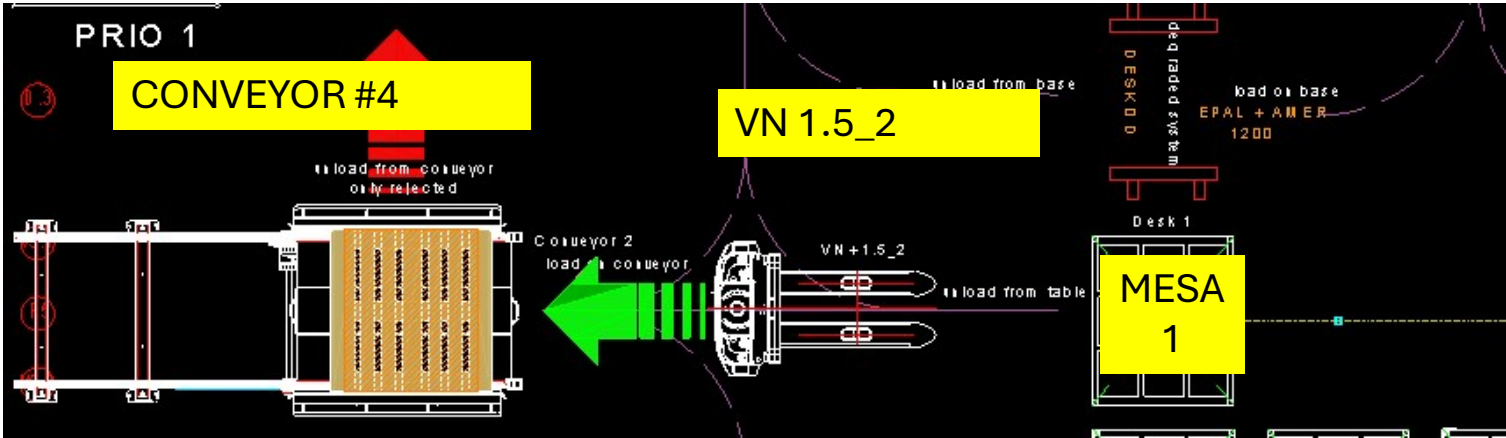
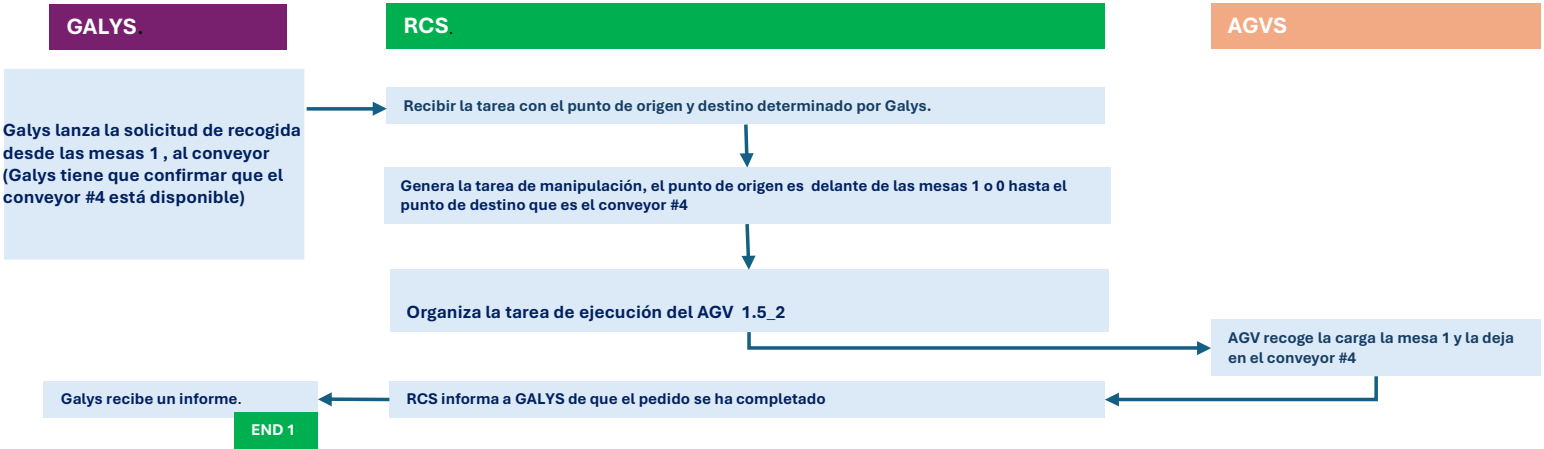


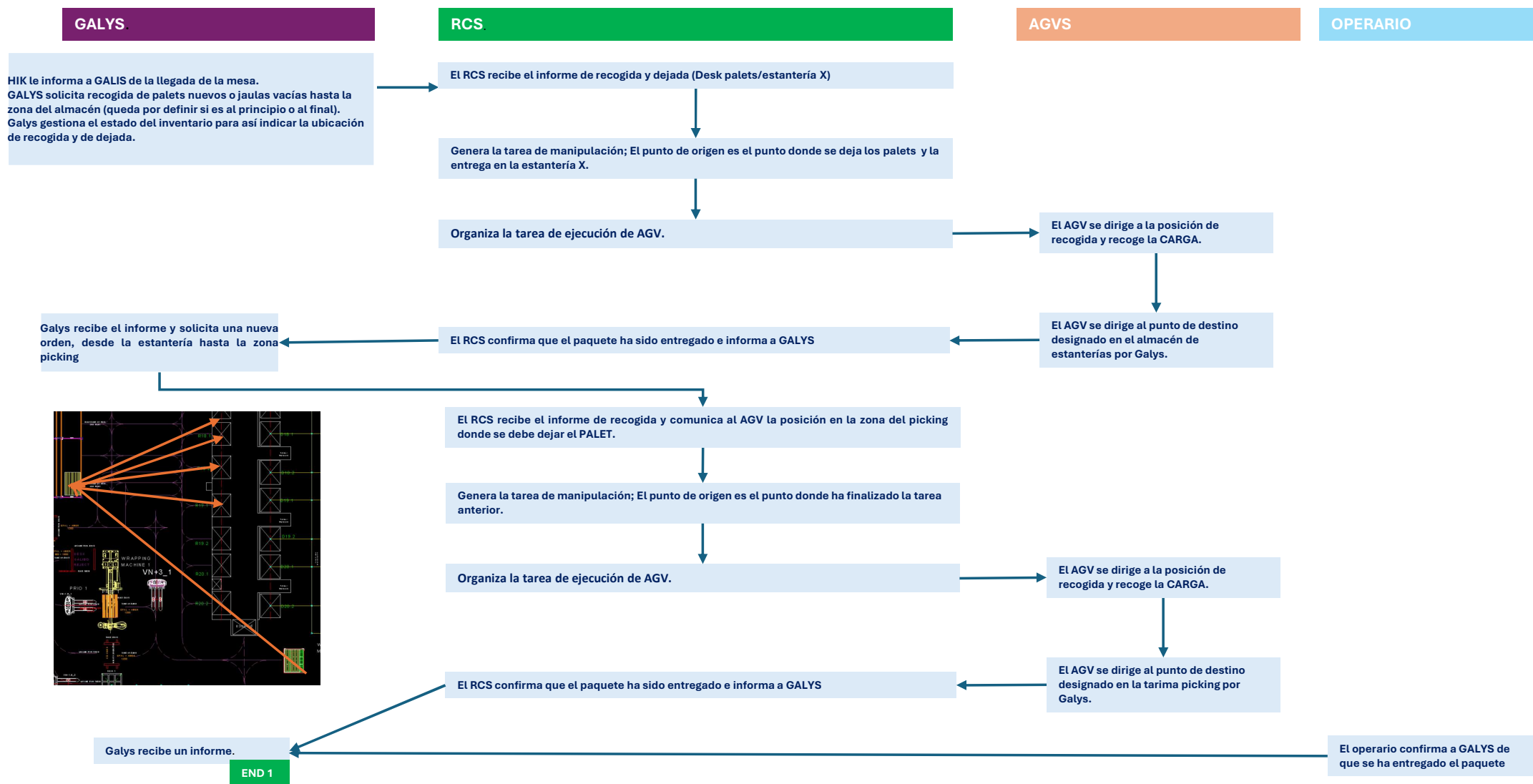
PROCESO 7 SALIDA DESDE EL CONVEYOR #3 A LA MESA 2 Y RECHAZO A LA MESA 3

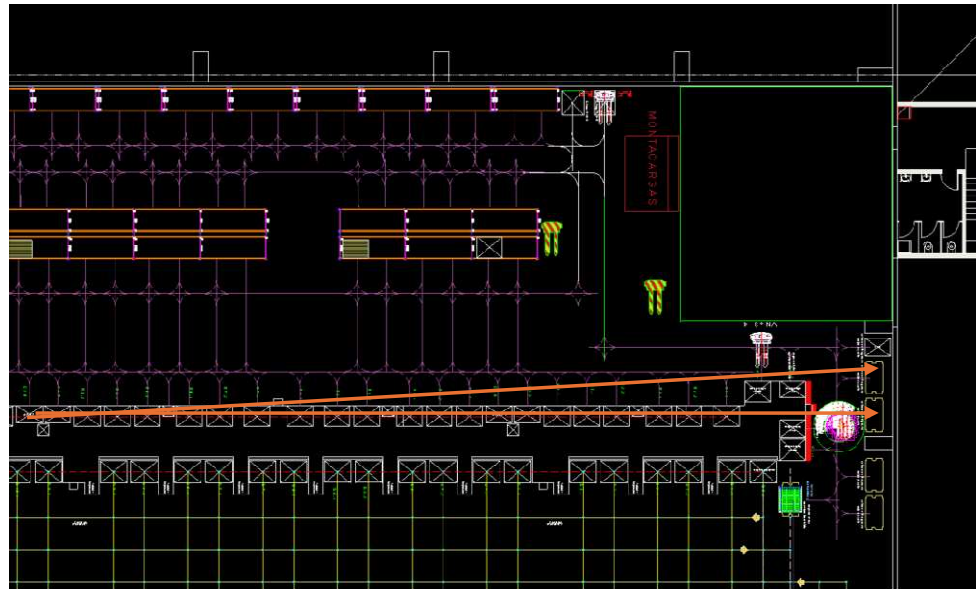
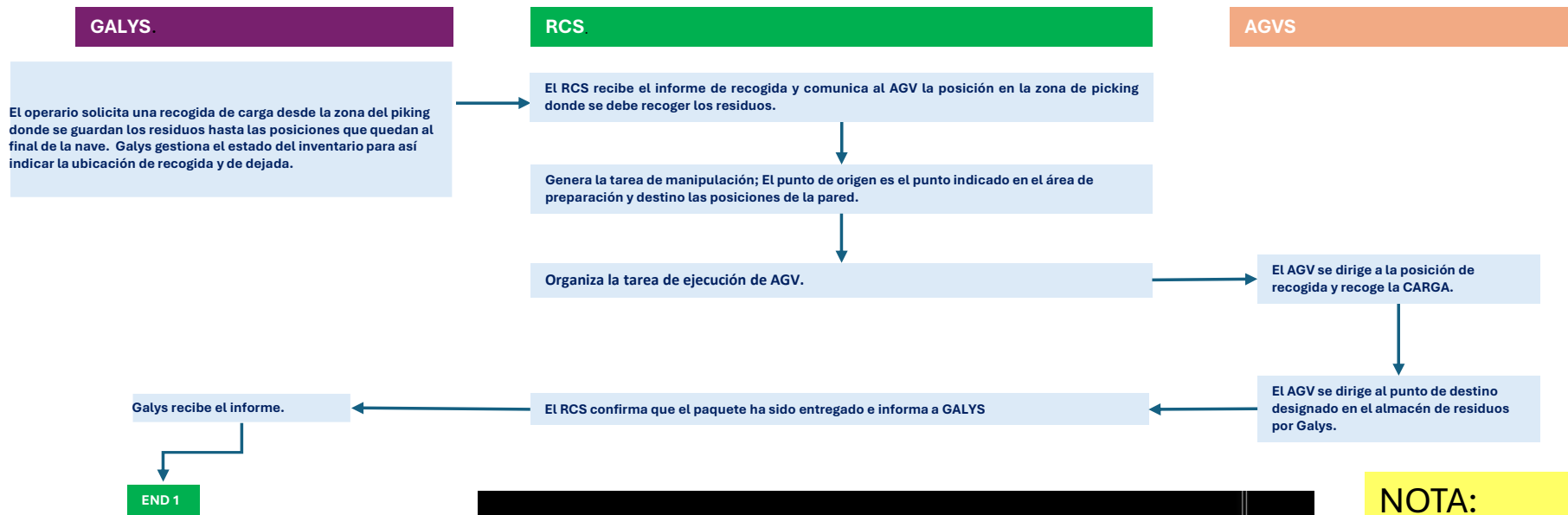


PROCESO 8 SALIDA DESDE EL CONVEYOR #3 A LA MESA 2 Y RECHAZO A LA MESA 3

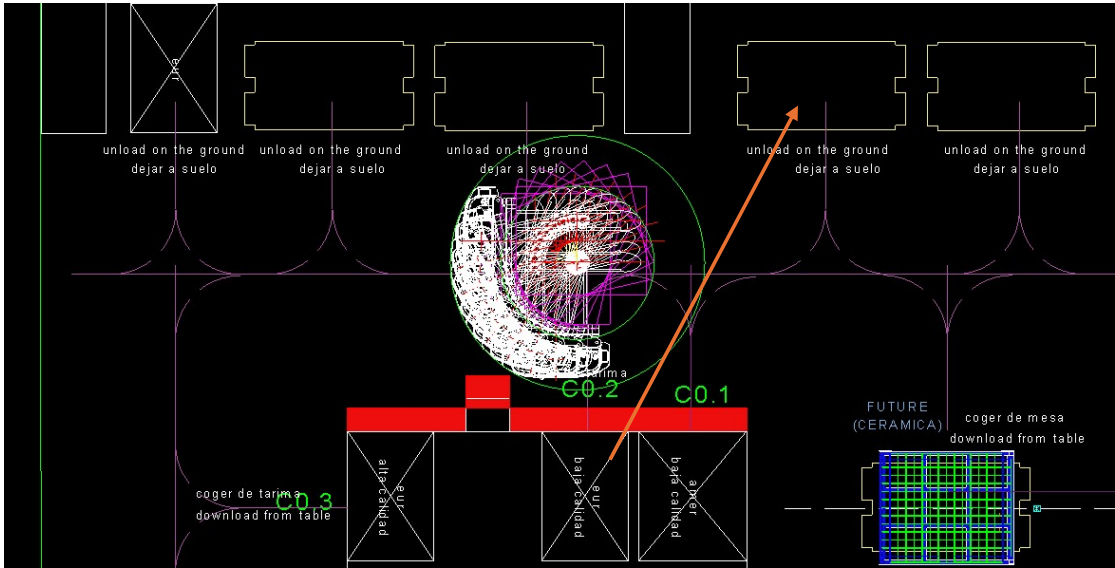
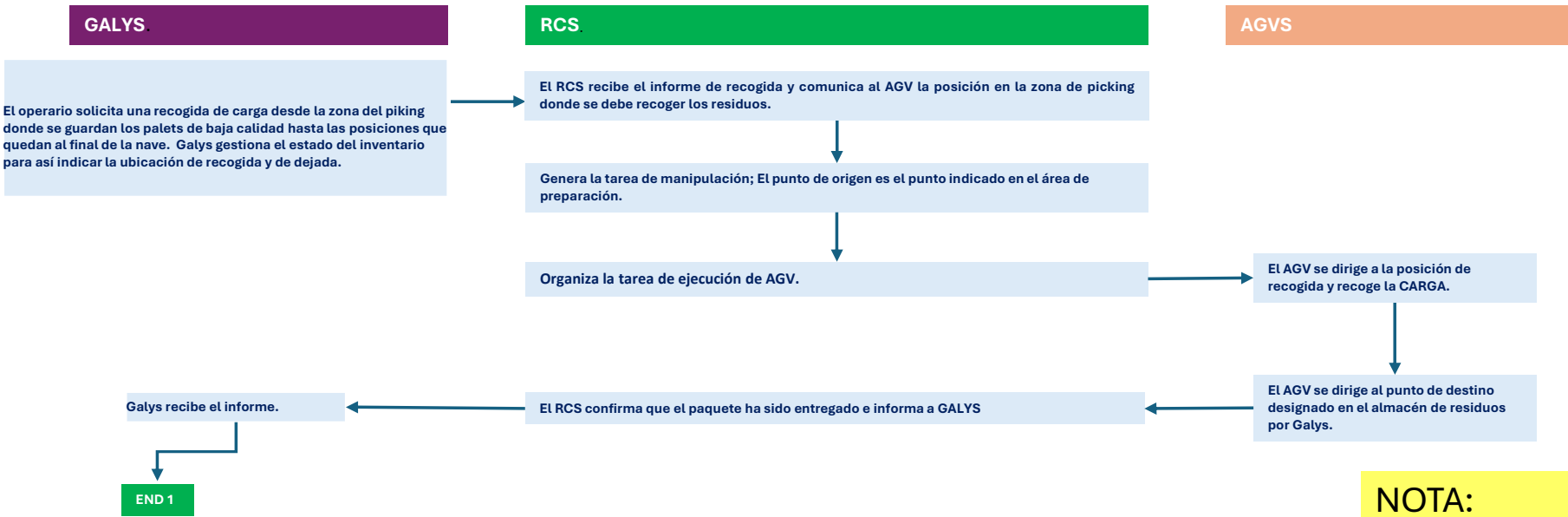








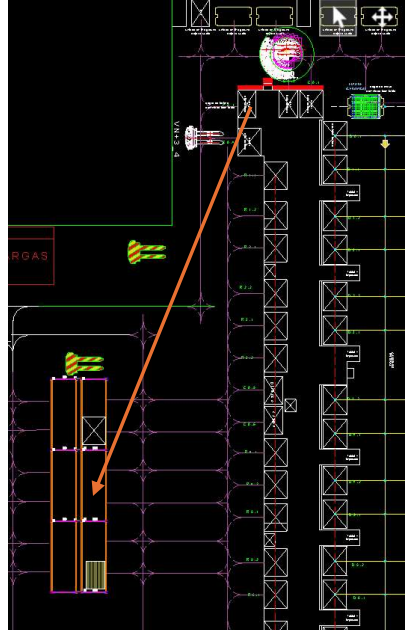
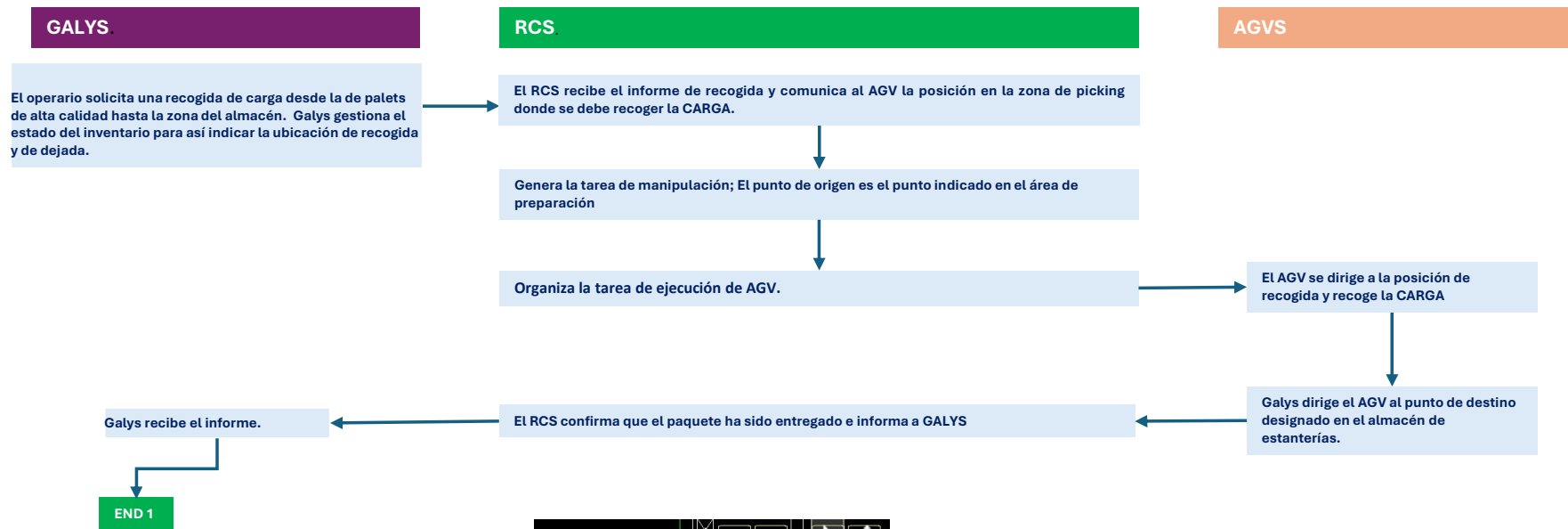
NOTA:
El operario tiene que mantener el RCS actualizado ya que una mala gestión de él impedirá que genere nuevas tareas. Es decir, tiene que dejar libres las posiciones de los contenedores en el RCS para generar nuevas órdenes.



NOTA:

El operario tiene que mantener el RCS actualizado ya que una mala gestión de él impedirá que genere nuevas tareas. Es decir, tiene que dejar libres las posiciones de los contenedores en el RCS para generar nuevas órdenes.

PROCESO 13 RECOGIDA DE PALET DE ALTA CALIDAD



- El AGV cuando para le manda inmediatamente un mensaje a GALYS informándole de la incidencia.
- El AGV 1.5_buckup está para sustituir al 1.5_1 y para los rechazos del conveyor #5.

```

VN+1.5_1:
- Operation beetween conveyor 1 / Gage desk 1 and 2 /wrapping machine 1
- Charge in "Charge +1.5 Station 3"
- VN+1.5_2 replaces VN+1.5_1 when it is in the charging station.
- When WM1 in out of service: between conveyor 1 and "degraded system"

VN+1.5_2:
- Operation beetween Desk 1 and conveyor 2
- Charge in "Charge +1.5 Station 3"
- VN+1.5_3 replaces VN+1.5_2 when it is in "Charge +1.5 Station 3".

VN+1.5_3:
- Operation beetween Desk 2 and conveyor 3
- Charge in "Charge +1.5 Station 3"
- VN+1.5_4 replaces VN+1.5_3 when it is in "Charge +1.5 Station 1 or 2".

VN+1.5_4:
- Operation beetween Desk 4 or 5 and conveyor 4. Prior Desk 4
- Charge in "Charge +1.5 Station 1 or 2"
- VN+1.5_5 replaces VN+1.5_4 when it is in "Charge +1.5 Station 1 or 2".

VN+1.5_5:
- Operation beetween Desk 6 or 7 and conveyor 5. Prior Desk 6
- Charge in "Charge +1.5 Station 1 or 2"
- VN+1.5_5 replaces VN+1.5_4 when it is in "Charge +1.5 Station 1 or 2".

VN+1.5_backup:
- Charge in "Charge +1.5 Station 3"
- When VN+1.5_5 backup is ready, parking in Home 1 (ready for unload
  rejected palet conveyor 1)

- operation from rejected position on conveyor 1 or 2 and R_Rack1 or R_rack2
- Replace VN+1.5_1 and 2 when are in charge station
- If when VN+1.5_backup is working the unload rejected order must be attend by
  machine in charge station

```



5. PLIEGO DE CONDICIONES

5.1. ACUERDO TÉCNICO CON VISIONNAV

ES2023122 Project

Technical Agreement

Document Number: AUTOCAR-VNJS2023122X

Customer: AUTOMATISMOS Y CARRETILLAS S.L.

Supplier: VisionNav Robotics Limited (VisionNav)

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1. General

This agreement has been developed between **AUTOCAR (Party A)** and **VisionNav (Party B)** to implement AGV to the SALTOKI new warehouse in Spain. Both are hereinafter referred to individually as a “Party” or together as the “Parties”.

- 1) This agreement serves as a standard to be jointly observed by both parties during ordering, production, and delivery acceptance.
- 2) The contents not explicitly stated in this agreement shall not be considered as acceptance condition, but can be resolved through negotiation.
- 3) This agreement, as an integral part of the contract, shall have the same legal effect as the contract after being signed and stamped by both parties.
- 4) In case of any discrepancy in technical terms between this agreement and the contract, the requirements of this agreement shall prevail.
- 5) This agreement is made in duplicate, with Customer holding one copy and supplier holding one copy. It shall come into effect after being stamped by both parties and signed by authorized representative;

2. Project technical requirements

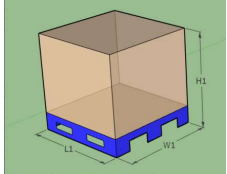
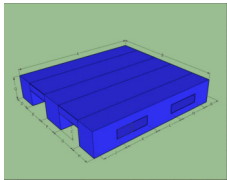
2.1 Operating Environment

The VisionNav AGV system is to operate in the following environmental conditions.

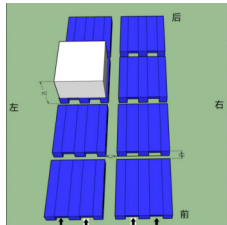
Table 2.1 Site operating environment information

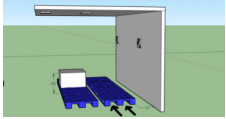
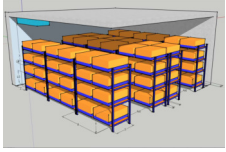
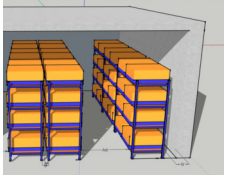
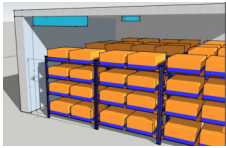
On-site environment check				
Index	Dimension	Properties	Description	Remark
1	Ground	Groove Width (mm)	20	
2		Step Height (mm)	10	
3		Operating Floor Bearing Capacity(kg/m ²)	1600 kg/m ²	
4		Ground Slope (°)	3°	
5		Ground Flatness (mm/m ²)	≤ 5mm/m ²	
6		Ground Material	Concrete	
7		If there is Oil/water (friction, ground friction coefficient)	Not applicable	
8	Environment	Light Condition	Indoor and no direct sunlight	
9		Dust	Not applicable	
10		Fugitive dust	No	
11		Working Area Temperature	-5°C ~ 40°C	
12		Working Area Humidity	20-95% RH	
13		Will it Rain in working area?	No	
14		If there are special gases in working area?	No	
15		Charging voltage and power (kw) of one charger	220V, 5KW	
16		Network	WIFI 2.4G/WIFI 5G (provided by Party A)	
17		Mix with operator or not?	Yes	
18		Minimum Entrance Width & Height for AGV (Door/Elevator) (mm)	2000mm width x 3000mm height	

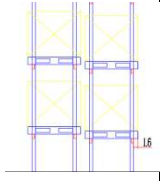
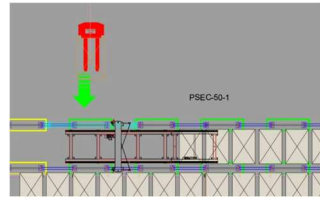
19	Unloading Scheme	AGV's Entrance Ground Condition(slope/groove/step)	Slope < 3°, groove < 20mm, step < 10mm	
20		Unload tool	Provided by Party A	
21		Transportation Aisle	Minimal 2000mm width	
22		Storage Position	On site	
23	Layout	Minimum Aisle Width in Stacking Area (mm)	2192mm	
24		Minimum Aisle Width for 90° Turning (mm)	1751mm	
25		Minimum Aisle Width of One-way Aisle (mm)	3196mm	
26		Minimum Clear Height of Working Area(include door height) (mm)	3000mm	
27		Minimum Clear Height of Lifting Area (mm)	Over 3000mm	
28		Charging Location/ Power Distribution	Please refer to Chapter 5.1	
29		Location of Network AP	Provided by Party A	Reference solution layout
30		Server Rack Installation Location	Provided by Party A	Reference solution layout
31		Peripheral module installation location	Please refer to Chapter 5.1	Reference solution layout
32	Path Planning	Path Design (One-way/Two-way)	Refer to Chapter 5.1	Reference solution layout
33		Location design	Refer to Chapter 5.1	Reference solution layout
34		If have restricted Area?	Not applicable	Reference solution layout
35	Carrier	Actual Picture of Carrier with Cargo		Broken carrier will not be handled by AGV system.

			 	
36		Material and Color of Carrier	1. Wooden pallet with wooden color. 2. Metal cage with columns silver color, nonreflective (Autocar will test the prototype with SLIM) 3. Yellow Dust bin with grey bottom.	
37		Carrier & Cargo Dimension $L1 \times \text{Width } W1 \times \text{Height } H1$ (mm)	Load 1 (EPAL): 1200 x 800 x 1960mm Load 2 (Cage): 1200 x 1000 x 1960mm Load 3 (Dust bin): 1370 x 778 x 1320mm	
38		Carrier Dimension Length $A \times \text{Width } B \times \text{Height } Q$ (mm)	Load 1 carrier (EPAL): 1200 x 800 x 144mm Load 2 carrier (Cage): 1200 x 1000 x 1960mm Load 3 (Dust bin): 1370 x 778 x 1320mm	
39		The Dimension of Fork Entry side B/A (mm)	Load 1: 800mm Load 2: 1000mm Load 3: 1370mm	
40		Inner Width of Fork Entry Side $E+F+G/K+L+M$ (mm)	Load 1: 600mm Load 2: 792mm Load 3: > 600mm, < 800mm	

41		The Middle Block Width of Fork Entry Side F/L (mm)	Load 1: 145mm Load 2: 145mm Load 3: Not applicable	
42		Pallet Entry Hole Clear Height C/P (mm)	Load 1: 100mm Load 2: 165mm Load 3: 170mm	
43		The Outer Block Width of Fork Entry Side D,H/JN (mm)	Load 1: 100mm Load 2: 104mm Load 3: 40mm	
44		Carrier + Cargo Actual Load Center (mm)	Load 1: 600mm Load 2: 600mm Load 3: 315mm	
45		Whether the vehicle should be treated with anti-slip	No	
46		Whether the cargo is uniform on the carrier (if not, the position of the center of gravity needs to be informed)	Yes	
47		Physical properties of the goods (high value, fragile, explosive, flammable, dumpable, corrosive, polluting, antistatic, etc.)	Not applicable	
48		Maximum Weight(Cargo + Carrier) (kg)	1000kg for load 1. 500kg for load 2. Max 500kg for load 3.	
49	Cargo	Maximum Height (Carrier included) H1 (mm)	Load 1: 1960 mm Load 2:1960 mm Load 3:1320 mm	
50		Maximum Height of Docking Platform (mm)	750mm	SmartPal conveyor height
51		Cargo place Accuracy Requirement(mm)(ground)	±20mm	The tolerance range for actual scenario release of goods
52		Cargo Picking Accuracy Requirement(mm)(ground)	±20mm	The tolerance range for actual scenario release of goods
53		Cargo place Accuracy Requirement(mm)(conveyor)	±20mm	The tolerance range for actual scenario release of goods
54		Cargo Picking Accuracy Requirement(mm)(conveyor)	±20mm	The tolerance range for actual scenario release of goods

55		Way of Cargo Placement	Not stacked	
56		Whether the cargo overhangs the carriers	No	
57		If the cargo overhangs the pallet, please give the real side and dimension	Not applicable	
58		Whether the cargo is at risk of falling	No	
59		The way the cargo is fixed on the carrier?	Pallets with filament. Cages without any wrapping.	The warping material should not block the fork entry pockets.
60		The offset of the center of gravity	Not applicable	
61		Palletizing method (Height) (mm)	Not applicable	
62		Cargo without carriers (Properties)	Not applicable	
63	Efficiency	Efficiency requirement	Refer to Chapter 5.9	
64		Working time	24 hours	
65		Cargo handling process: 1) Each process indicates the accuracy of the cargo placement 2) Indicate the planned location form, the spacing of the location, and the number of locations 3) Attached scheme flow chart	Refer to Chapter 5.2	
66		Other	Not applicable	
67	Line storage area	Layout of line storage area	Refer to Chapter 5.3	
68		Cargo height (Including pallet/cage) H2 (mm)	1960mm	
69		Front and back safety gap W2 (mm)	Refer to Chapter 5.3	
70		Left and right safety gap L2 (mm)	Refer to Chapter 5.3	
71		Line storage area labeling method	On the ground with line marker	
72		The distance between the border of the line storage area and the	Refer to Chapter 5.3	

		wall L3 (mm)		
73		others	Not applicable	
74	Racks	Racking pictures	Refer to Chapter 5.3	
75		Clear width of one single rack: R (mm)	2700mm	
76		The clear depth of a single rack: S (mm)	1100mm	
77		The number of pallets per layer of a single rack	3	
78		Clear height of every level of the rack :T (mm)	At least 2110 mm (min 150mm height clearance)	
79		Gap between the back to back rack:U (mm)	300 mm	
80		Gap between the back to back cargo/pallet:V (mm)	200 mm	
81		The distance between the cargo and the wall after the rack is placed the cargo/pallet: W (mm)	Not applicable	
82		Clear width of aisle in racking area (minimum stacking 90 ° width)Ast (mm)	3196mm	
83		Clear height of the racking area :X (mm)	Over 7.5 meters	
84		Maximum lifting height of racking area :Y (mm)	Ground only	
85		The distance between the left and right ends of the beam rack and the wall :Z (mm)	Over 2000mm	
86		Clearance distance above cargo after placement : L4 (mm)	At least 150mm	
87		Clearance above the first layer of the rack after placing cargo L5 (Forward Moving vehicle required) (mm)	At least 150mm	
88		Perpendicularity of left and right rack (mm)	Within ±5mm	
89		Front and rear perpendicularity of	Not applicable	

		rack (VNA scenario) (mm)		
90		The cargo exceeds the length of the crossbeam by L6 (mm) on the crossbeam	50mm	
91		Height of first layer rack (mm)	Over 2110mm	
92		Others	Not applicable	
93	Feeder stations/conveyor belt	Photo of Conveyor Line		
94		Dimensional of conveyor line docking structure	Refer to Chapter 5.4	
95		Signal interaction mode between AGV and conveyor line	SmartPallet conveyors and RCS communication is done via OPC-UA	
96		Conveyor line type and photo (Power drum, Unpowered drum, Chain?)	Chain conveyor	
97		Mechanical limit (side pickup) (end limit, left and right limit)	There is mechanical end limit and guideways.	
98		Optoelectronic limit (side pickup) (diagonal facing installation, end facing installation)	There are photoelectric sensors for load confirmation on the side for all exits and entrances. There are also arch gates with photoelectric sensors for height detection for all entrances and only one exit.	
99		Distance between the pallet and the edge of the conveyor line (side pickup) (mm)	<20mm	
100		Temporary storage space for conveyor line (fast paced scenario)	There is one buffer in each conveyor lines in SmartPal.	
101		Whether interfering with adaptive laser	No	
102		Does the conveyor line bracket interfere with the forklift's load-	No	

		bearing wheel		
103		Left and right clearance (cargo release) of the conveyor line (bell mouth, secondary centering mechanism)	$<\pm 30\text{mm}$	
104	Information Flow	Client Upper System Type	Galys	
105		Task Call Method	Upper System	
106		Task Processing	Single task processing/Batch task/abnormal task processing	
107		Data synchronization/reporting	Not applicable	
108		WCS Functionality	conveyor line information exchange	
109		UI Customization	Not applicable	

Remarks: This Technical agreement is developed and approved between Customer and VisionNav base on above information which is provided by Customer and not measured by VisionNav engineer or representative. Any inaccurate or inconsistent information may result in changes to the agreement. Both parties may sign a supplementary agreement on the change through friendly negotiation, the specific cost shall be subject to the actual occurrence.

2.2 System and peripheral interfacing requirements

System integration with Galys, communication protocols: HTTPs via REST API.

2.3 Network (WiFi) construction party:

Party A (Party A provides the network. If the equipment cannot operate normally due to on-site network, Party A shall upgrade and improve the network to meet the needs of unmanned forklift operation).

3. Project Bill of Material

3.1 Project List

1. AGV Hardware							
No.	Item	Description	Brand	Model	Quantity	Unit	Remarks
1	AGF	SLIM Pallet Stacker Forklift AGV(SL)	Visionnav	VNSL14(VL)-07	14	/	Standard mast

2	Charger	Auto Charger 24V100A	Titan	VN-SAC-24V100A	8	/	
2. Site Facility Hardware							
No.	Item	Description	Brand	Model	Quantity	Unit	Remark
1	Reflectors	50cm x 8cm (Diameter)	Visionnav	/	100	Set	Placement based on site condition
2	Docking module	Compactor docking module	Visionnav		6	Set	No installation required
3. IT Hardware							
No.	Item	Description	Brand	Model	Quantity	Unit	Remark
1	Central control system server	CPU: 32 cores, 64 threads at 2.10GHz RAM:64GB Hard disk: 4TB Bandwidth: 50M exclusive or 100M shared fiber, 5G is the same. Static IP of public network	Dell	Dell R750XS Intel Xeon Silver 4314*2, other equivalent or better configuration server. Monitor SE2422H with HDMI	1	Set	*Provided by Party A *For more specific information, please refer to “System server” and “System WIFI requirement ” annex. *For 30-50 vehicle units
2		Windows server 2016 above	Windows	windows sever2016 （default）or 2019 version （customizable）	1	Set	/
Remark: The wireless AP/5G network and the whole set of network equipment, handheld PDA, server, etc. shall be provided by Customer;							
4. Center control system software							
No.	Classificati on	Item	Function	Brand	Description	Remark	
1	Center control software	Center control system	Vehicle Schedulin g module	Visionnav	Number of cars: （14）	/	
2			Storage location	Visionnav	Number of storage	/	

			managem nt module		locations: (360)	
3			Process managem nt module	Visionnav	Number of process (9)	/
5			Inbound/O utbound strategy module	Visionnav	Number of inbound strategy (1); Number of outbound strategy (1)	/
9		Docking system	System docking module	Visionnav	Common ways to adapt to customer agreements: HTTPs	via REST API
12		Interface customization	Report customizat ion	Visionnav	Number of reports (8)	/
13			Monitor customizat ion	Visionnav	Number of monitor pages (1)	/
14		Device docking	Conveyor docking	Visionnav	Number of devices (5)	/
16						
17						
18			Compactor docking	Visionnav	Number of devices (2)	/

Note: supplier only provides materials within the list. If customer has other requirements, any additional fees incurred shall be negotiated and quoted by both parties.

The supplier only provides materials within the list. If the customer has other requirements, any additional costs incurred shall be negotiated and quoted by both parties;

The on-site charging pile cables and cable trays shall be provided by customer, and the power supply shall be pulled to the designated position of supplier and equipped with the designated joints;

The on-site network, network auxiliary materials and implementation, server power consumption, and various power plugs shall be provided by customer;

4. Project Equipment Introduction

4.1 AGV Detail Specification

The color and logo of the AGV can be customized. This project requires the color of the AGV to be:

SL14-07

AGV body: BLACK RAL 7021 MATTE (NON-GLOSS PAINT)

Lower cover: RED RAL 2002 MATTE (NON-GLOSS PAINT)

Mast and other color: BLACK RAL 7021 MATTE (NON-GLOSS PAINT)

Logo requirements: Add Autocar's logo onto VisionNav's Slim AGV at the places shown in below.



Figure 4.1 AGV picture

4.2 Technical parameters of AGF (final parameters are subject to actual design)

No.	Name		Technical parameters
1	Model		VNSL14(VL)-07 CE
2	Navigation		3D SLAM Navigation
3	Vehicle quality (including battery)		≈1000kg
4	Vehicle size (L*W*H)		1642mm x 994mm x 1950mm (The actual drawing shall prevail)
5	Effective fork length*width*thickness		60mm x 180mm x 1150mm
6	Fork outer width		560mm
7	Fork inner width		200mm
8	Manual operation method		Hand-held device
9	Rated load capacity		1400kg
10	Load center distance		600mm
11	Fork max lift height (not cargo placement height)		1600mm
12	90° stacking aisle width (800*1200mm pallet, fork insertion side 800mm)		2200mm
13	Stacking accuracy		±20mm
14	Maximum Driving speed	Straight Forward with Full-Load	1.3 m/s
15		Straight Forward with Empty-Load	1.0 m/s
16		Straight Backward with Full-Load	0.3 m/s
17		Straight Backward with Empty-Load	0.3 m/s
18	Maximum	Empty-load	3°
19	climbing ability	Full-loaded	3°

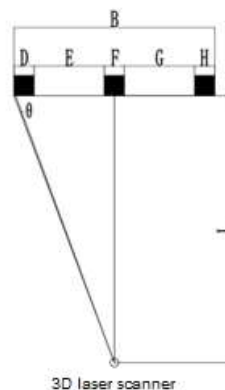
20	Safety Protection	Non-contact protection	Laser scanning protection
21		Contact safety protection	Anti-Collision Bumper
22		Others	Emergency stop switch + Acousto-Optic Alarm
23	Battery Parameters	Type	Lithium Battery
24		Capacity	180Ah*24V
25		Charging mode	Automatic charging

Remark:

- ✓ AGV final specification and parameters shall be subjected to actual design approved by Customer and VisionNav.
- ✓ Final parameters are subject to actual design.
- ✓ Actual drawing shall prevail.

4.3 AGV perception function (Mid 360, non servo sensing)

Pallet dimension:



B: The dimension of the pallet, fork entry side;

Circle: The location of the perception sensor at the bottom of the fork

L: The distance between perception laser scanner and the pallet.

D/F/H: the width of the pallet columns.

E/G: the width of the pallet's insertion holes.

1. Non black pallet, Column height $\geq 60\text{mm}$, hole width (Column spacing) $\geq 100\text{mm}$;

When $100\text{mm} \geq \text{Column width} \geq 60\text{mm}$, $600\text{mm} \leq \text{detection distance} \leq 2600\text{mm}$, it meets the requirements of 3D laser sensor for pickup detection (pallet fork face width $\leq 1200\text{mm}$);

When $100\text{mm} \geq \text{Column width} \geq 60\text{mm}$, $600\text{mm} \leq \text{detection distance} \leq 2600\text{mm}$, it meets the requirements of 3D laser sensor for pickup detection (pallet fork face width $\leq 1800\text{mm}$);

When $100\text{mm} \geq \text{Column width} \geq 60\text{mm}$, $900\text{mm} \leq \text{detection distance} \leq 2600\text{mm}$, it meets the requirements of 3D laser sensor for pickup detection (pallet fork face width $\leq 2400\text{mm}$);

1) Single or multiple columns require testing to determine whether they can be identified, and 2-3 columns do not require testing;

Attention items (unsupported types of goods): wrapped film (to be tested), mirror material, light absorbing material (to be tested), glass, obstruction in front of the cargo, hollow column, wheeled cargo, vehicle damage exceeding a certain degree;

4.4 AGV fork dimension overview

Load type 1 (EPAL):

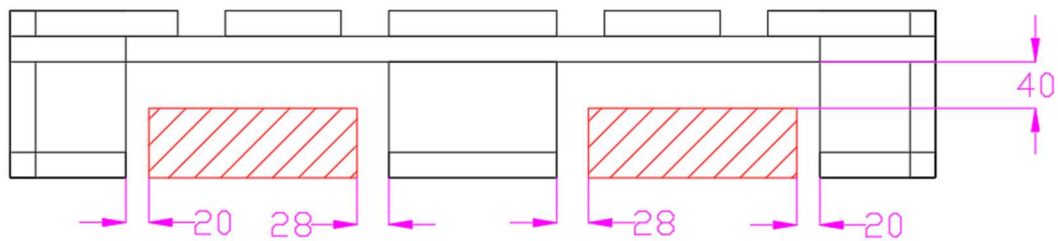
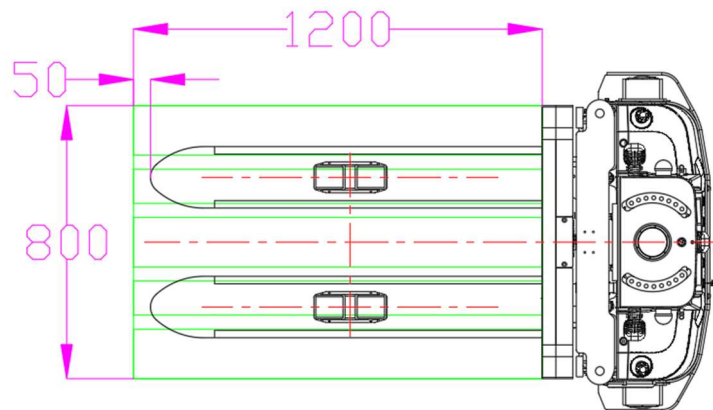


Figure 4.4.1: Fork insertion for EPAL



Load type 2 (Cage):

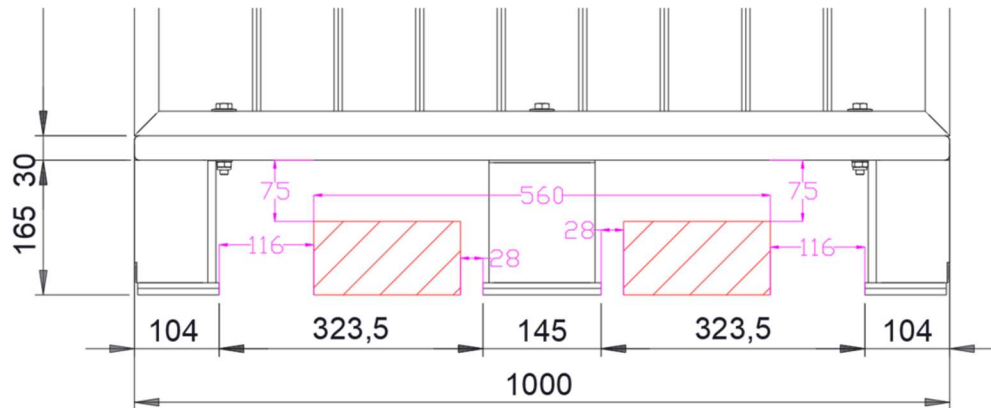
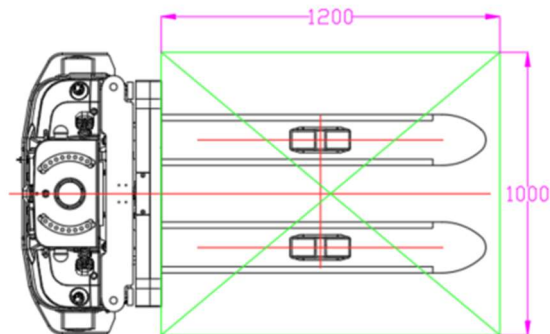


Figure 4.4.2: Fork insertion for Cage



Load type 3 (Dust bin):

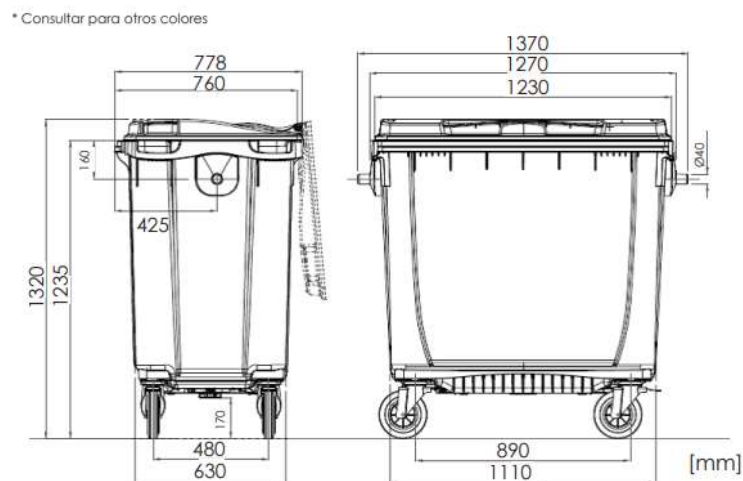


Figure 4.4.3: Original drawing of the dust bin



Figure 4.4.4: Modification requirement of the dust bin

The added columns will have closed profile.

4.5 AGV charging instructions

The AGV charging system supports idle charging and low battery forced charging with the following charging strategies.

Idle charging strategy: when the power of AGV is lower than the set threshold (generally set to 80%) and there is no task queue, AGV automatically executes the charging task. When there is task queue, AGV automatically terminates charging task and executes corresponding task;

Low battery forced charging strategy: when the power of AGV is lower than the set threshold value (generally set to 30%), the AGV will execute the charging task after completing the current task, during which the AGV will not receive the tasks issued by the system until the charging power reaches the set threshold value (generally set to 80%) before it can continue to receive the tasks issued by the system.

[Note that the power condition of the site is 220V-240V@32A (EU Plug with Earth).]

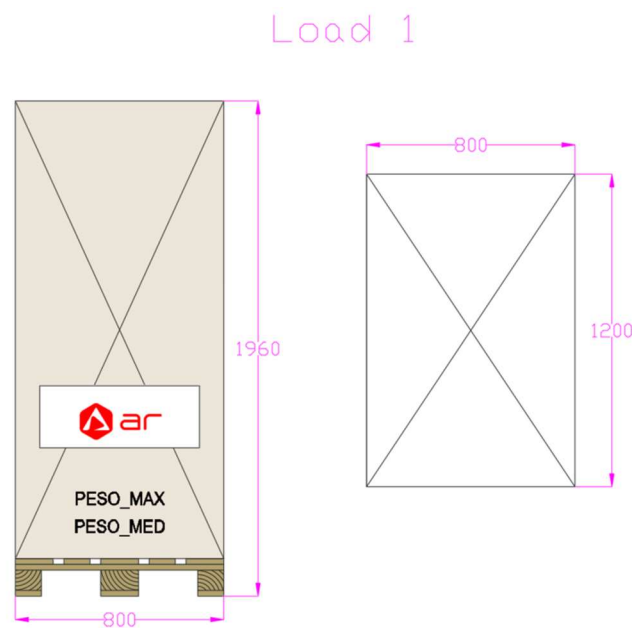
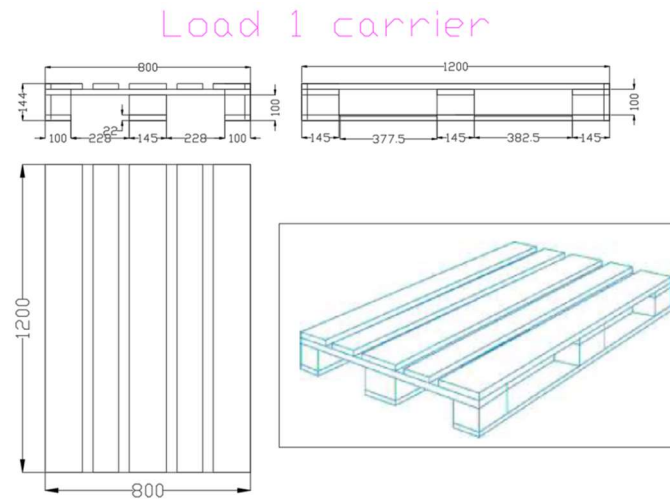


Figure 4.2 Schematic diagram of the AGV charging post

5. Project Technical Solution

5.0 Load's information

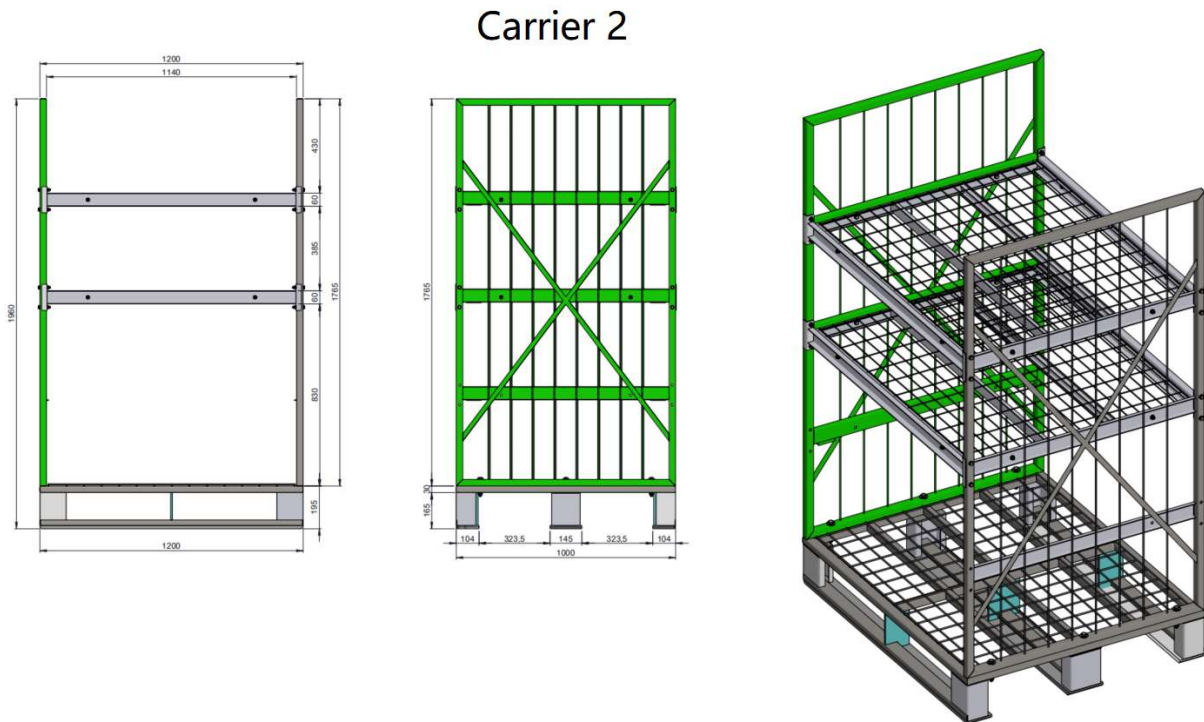
Load 1 type:



- Load 1 information: 1200 x 800 x MAX height 1960 mm with EPAL.
- Fork insertion side: 800mm.
- Load center: 600mm.
- Goods are fixed on the carrier without movement.
- No filament covering the pallets' pockets.

- No overhang.
- Wooden pallets.
- NO reflective material on carrier.

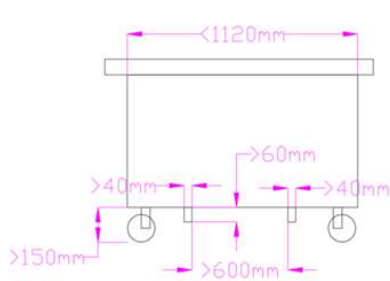
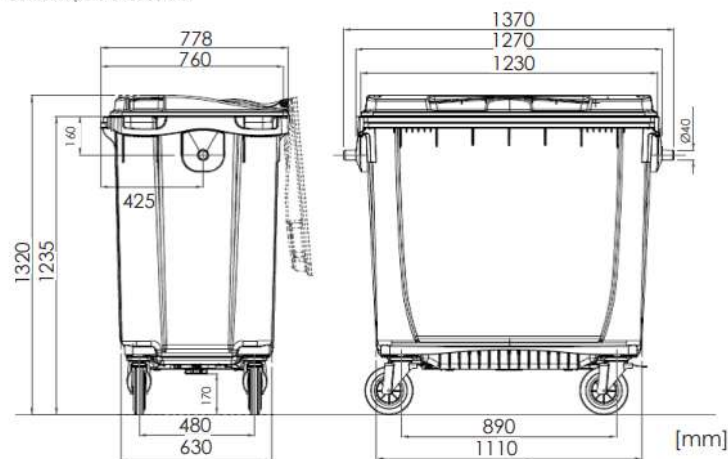
Load 2 type:



- Load 1 information: 1200 x 1000 x 1960 mm.
- Fork insertion side: 1000mm.
- Load center: 600mm.
- Goods are fixed on the carrier without movement.
- No filament covering the pallets' pockets.
- No overhang.
- Silver and green metal cage (To be tested by Autocar for final confirmation).
- NO reflective material on carrier.

Load 3 type:

* Consultar para otros colores



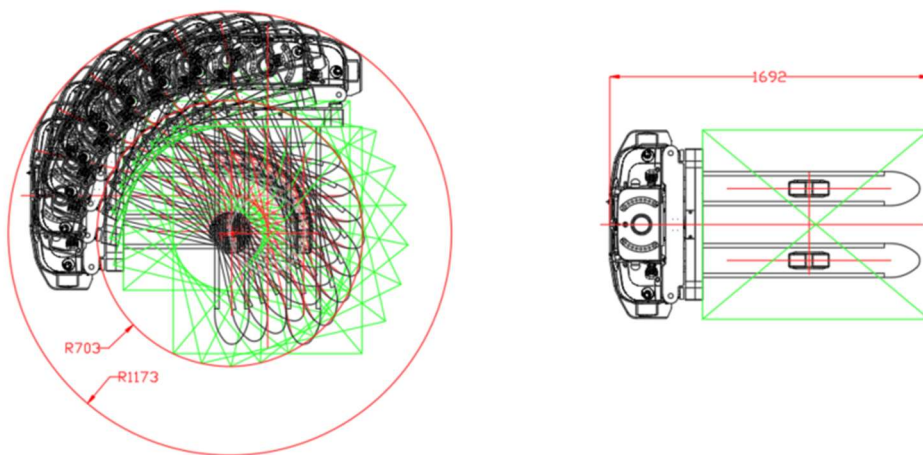
- Load 3 information: 1370 x 778 x 1320 mm.
- Fork insertion side: 1370mm.
- Load center: 315mm.
- Max weight: 300kg.
- No filament covering the fork insertion pockets.
- No overhang.
- The holes at the bottom of the dust bin should be closed for perception module detection.
- Autocar has tested dust bin feasibility with SLIM for pick up.
- NO reflective material on carrier.

5.2.12 Flexible zone

The RCS UI needs to have a functionality so that the AGVs are zoned, which means the customer has the possibility of balancing the AGVs manually in RCS UI. Example: if they have a breakdown in the inlet conveyors and there is a 2-hour repair forecast, it would not make sense for the AGVs not to attend to other flows.

5.3 Special notes on the operating area environment

5.3.1 Minimal 90 degree stacking aisle width: 2192mm

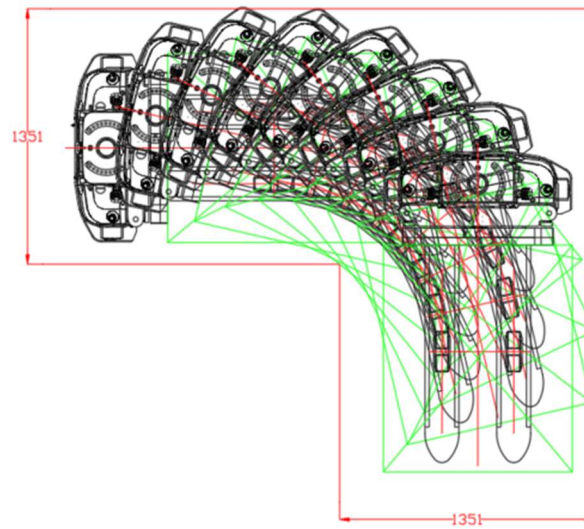


$$\text{AST1: } 703\text{mm} + 1173\text{mm} + 300\text{mm} = 2176\text{mm}$$

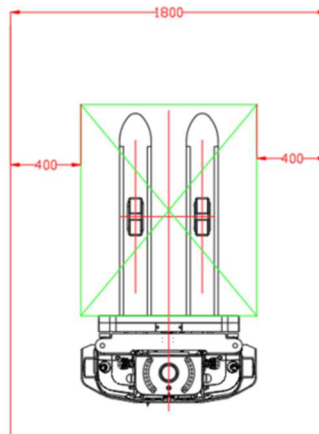
$$\text{AST2: } 1692\text{mm} + 500\text{mm} = 2192\text{mm}$$

$$\text{AST} = 2192\text{mm}$$

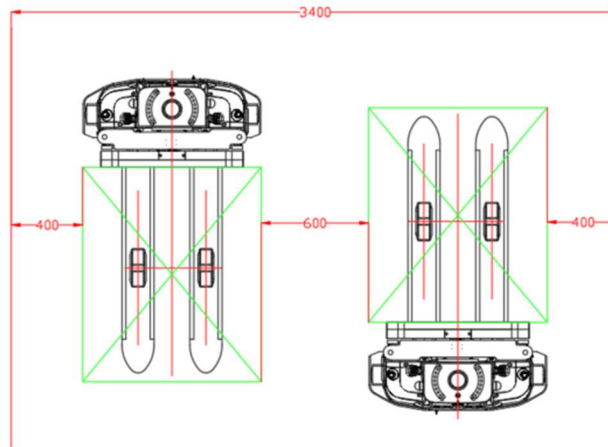
5.3.2 Minimal 90 degree turning aisle width: $1351\text{mm} + 400\text{mm} = 1751\text{mm}$



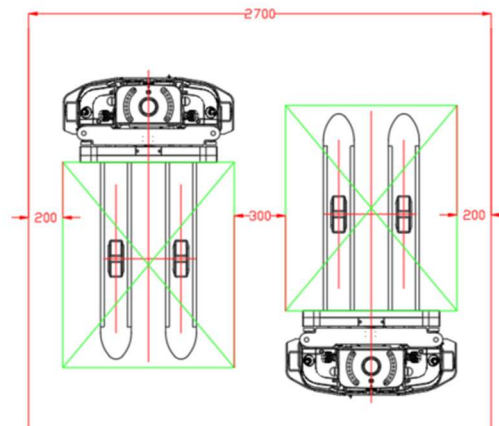
5.3.3 Minimal single path driving aisle width for max speed: 1800mm



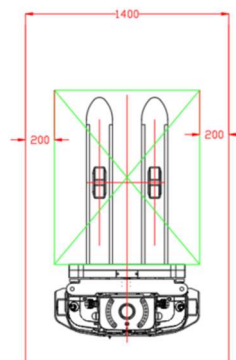
5.3.4 Minimal double paths driving aisle width for max speed: 3400mm



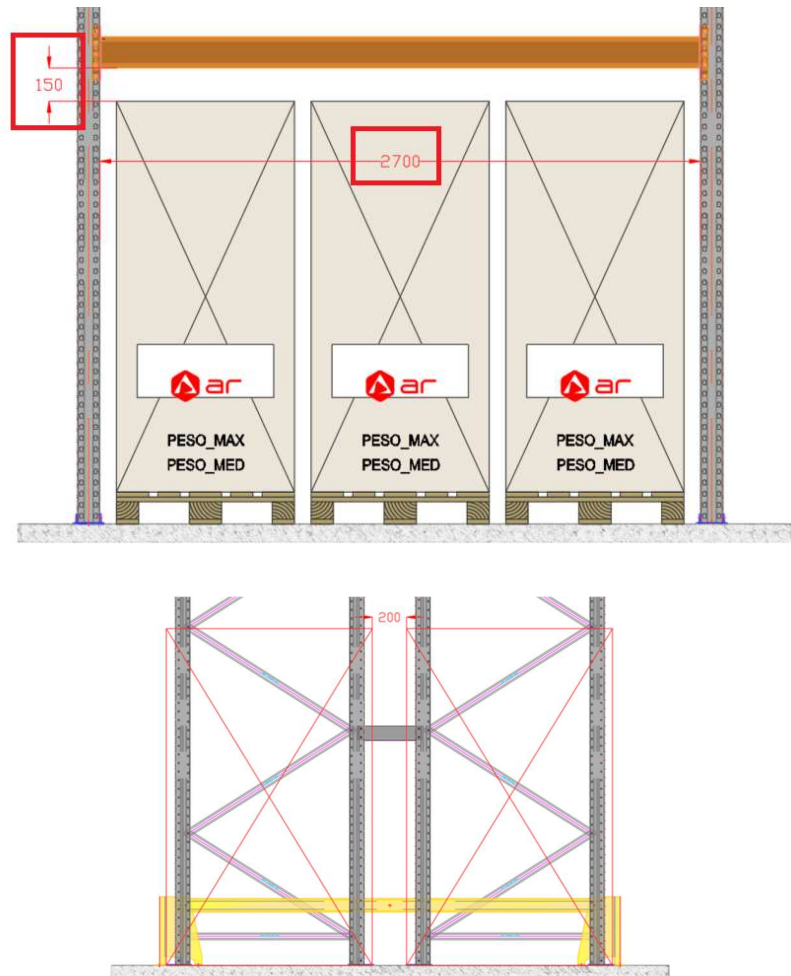
5.3.5 Minimal double paths driving aisle width: 2700mm



5.3.6 Minimal double paths driving aisle width: 1400mm



5.3.7 Rack warehouse requirement



The docking area for rack warehouse is only for ground level.

The clearance between the load's top surface and the beam needs to be at least 150mm.

The rack width needs to be at least 2700mm for three EPAL size loads (1200 x 800mm) and 800mm toward outside.

The distance between the loads back-to-back in the rack needs to be at least 200mm.

If the cage (1200 x 1000mm) needs to be stored into the rack ground level, ONLY two cages can fit into one rack bay.

6. Central control system design

6.1 VisionNav AGV Software Structure

The hardware environment for the central control system of supplier supports independent servers, cloud hosts, and virtual machines. The software environment is Windows Server 2016 (and later versions), and Microsoft is deployed Net Framework 6.0 and Microsoft Visual C++runtime environment. The database supports MySQL and MS SQL.

The central control system of Party B is installed on the server and communicates with the unmanned forklift through wireless local area network. The final stage of task flow is issued by the central control system to unmanned forklifts, which then carry out handling operations.

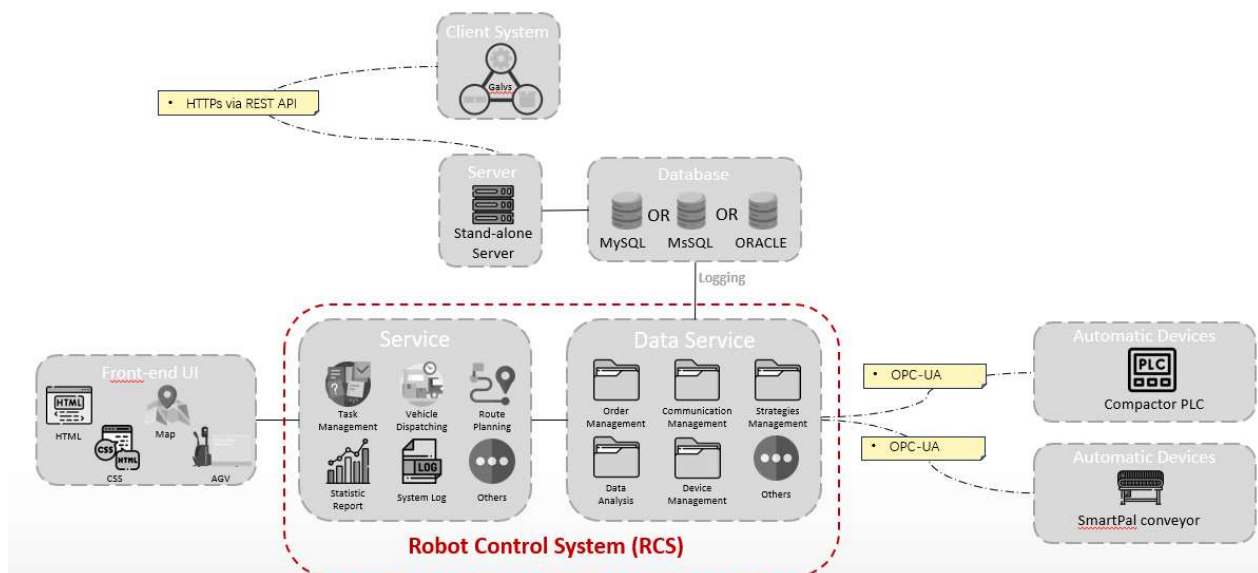


Figure 6.1 Architecture of AGV central control system

6.2 Software Function (Standard)

The functional design of the central control system should prioritize the implementation of the business process requirements of this project. On this basis, the following standard core functions are provided: vehicle dashboard, operation map, command management, vehicle scheduling and path planning, traffic control, communication management, and log management.

Table 6.1 Standard Central Control System Function Module Table

Index	Module	Description
1	AGV board	1. Real time reception of AGF status information, graphical display on the AGF dashboard page, achieving graphical monitoring of the vehicle. 2. The information includes: AGF number, AGF battery level, working mode, working status, driving speed, and abnormal information. 3. Provide AGF diagnosis function, update the current status of the AGF in real time for manual decision-making, such as blocking and abnormal information.
2	MAP	1. Support displaying storage locations, paths, and AGF location information on the map, achieving graphical intelligent monitoring of AGF and paths, including tracking AGF positions, displaying real-time paths, etc. 2. Provide one click all emergency stop function.
3	Instructions management	1. The standard RCSUI supports manual instructions for entering required information on the page, as well as issuing instructions using the standard RCS interface (excluding business processing and judgment). 2. The system manages instructions, including creation, tracking, modification, etc., and can provide feedback on the status of instruction nodes (including start execution and completion) to external systems through the interface of the standard RCS communication protocol. 3. Allow users to specify instruction priority when generating instructions, and the central control system plans to prioritize instruction execution.
4	AGF dispatch	1. Unify the scheduling of all VN AGF on site, flexibly design the driving path of AGF based on the site map, in order to improve operational efficiency. 2. When assigning tasks, the system will comprehensively measure parameters such as task information and vehicle location, and flexibly schedule the nearest vehicles that meet the conditions to perform handling operations.
6	Traffic control	1. In the scenario of multiple AGFs running on site, the central control system plans the path in advance when issuing tasks to avoid AGF deadlock. 2. In response to situations such as multiple AGFs meeting, plan traffic control in advance to ensure automatic and safe cooperation among multiple AGFs.
7	Communication Management	1. Under the premise of stable on-site network, comprehensively manage the communication between the central control system and the AGF. 2. Support multiple communication protocols to achieve information exchange between the central control system and external systems. 3. Support multiple IoT communication protocols to achieve information exchange or control with external devices.

8	Log management	1. Real time recording of AGF operation data, fault information, command status, and other information. 2. All information can be traced and located.
9	System docking	Support interface integration with third-party systems through standard RCS communication protocol, including issuing handling instructions, querying AGF information, querying abnormal information, and providing feedback on command status.

6.2.2. Central control system scheduling logic

According to the business process requirements of this project, the scheduling logic of supplier's central control system mainly includes two aspects.

One is instruction scheduling. After receiving the handling instructions, the central control system of Party B will sort them according to the priority of the instructions and prioritize the scheduling of unmanned forklifts to carry out the handling operations. If task priority is not specified, the central control system will sort tasks based on project business process requirements and instruction issuance time, and break down the handling instructions into actions that can be executed by unmanned forklifts, flexibly scheduling unmanned forklifts to perform handling operations. Note: Standard RCS only supports instruction types in the RCS communication protocol. Task splitting in third-party systems is not within the scope of instruction scheduling and depends on the business process requirements of this project.

The second is vehicle scheduling. After receiving the handling task, the central control system of Party B shall assign tasks and schedule vehicles according to the designated vehicles, and prioritize scheduling designated vehicles to carry out handling operations. If no vehicle is specified, the central control system will comprehensively measure parameters such as task information and vehicle location, and flexibly schedule the nearest vehicle that meets the conditions for transportation. On the premise of ensuring global task efficiency, flexibly plan the optimal driving path of unmanned forklifts to improve operational efficiency.

6.2.3. Central control system human-machine page

The supplier's central control system provides a backend service program (RCS, Robot Control System) with the goal of meeting project business process requirements, and provides

customer with a PC based human-machine interaction page (RCSUI, RCS User Interface). The main functions include AGF dashboard, real-time map, instruction management, fault statistics, user management, and other modules, supporting users to initiate, edit, report, and monitor instructions through visual pages Operations such as log viewing, map viewing, fault statistics, user settings, and role permission control.

User on-site can access RCSUI through computers or large screen terminals, remotely monitor tasks and vehicle status, view fault information and statistical reports. Based on on-site scanning maps, draw a flat map and display it on the task map page, providing users with a more user-friendly way to monitor the real-time trajectory and status of vehicle operation, and allowing users to select storage locations and quickly initiate tasks.

The RCS UI is a standard version that enables information retrieval and related operations, and is used in conjunction with RCS. It does not support modifications to existing features/pages. If it is found that the existing features/interfaces are different from the required features, paid customization is supported.

The reference diagram for the standard RCSUI section is as follows:

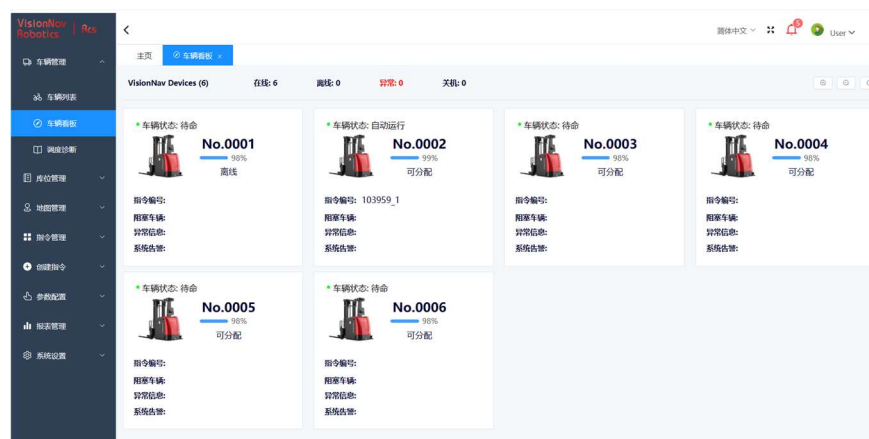


Figure 6.1 Vehicle Kanban Page

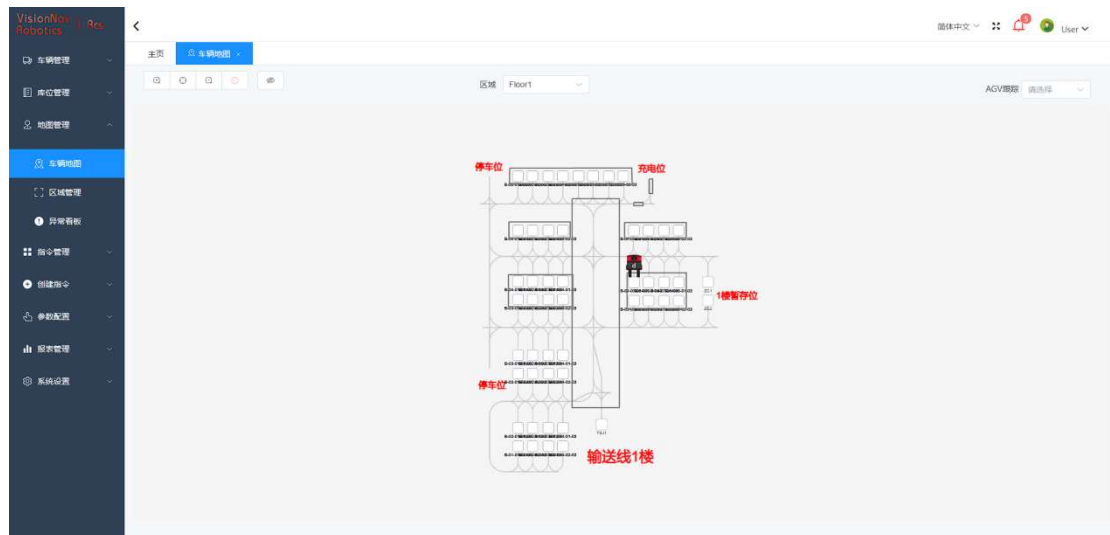


Figure 6.2 real time map

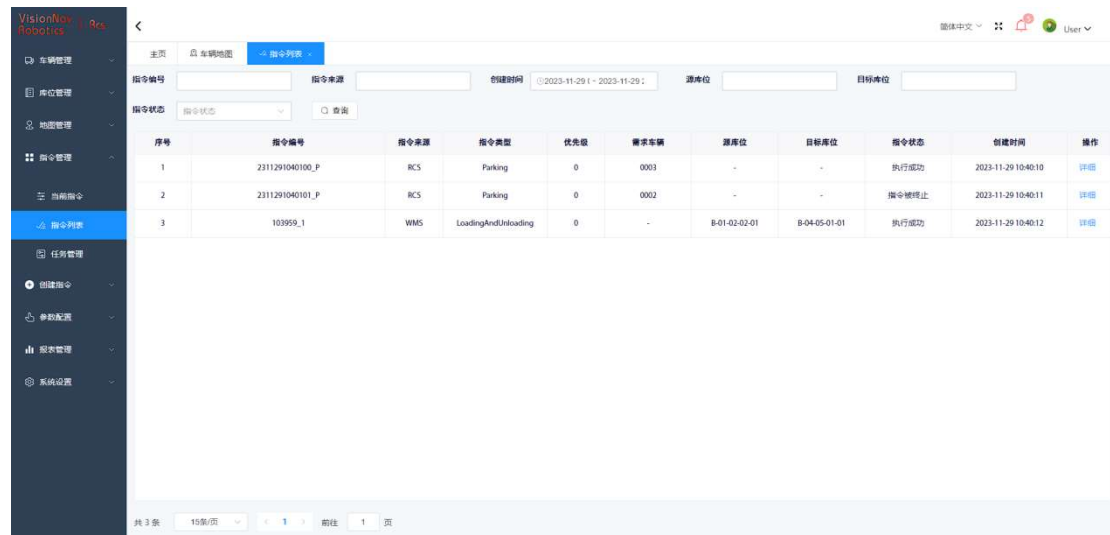


Figure 6.3 Instruction Management Page

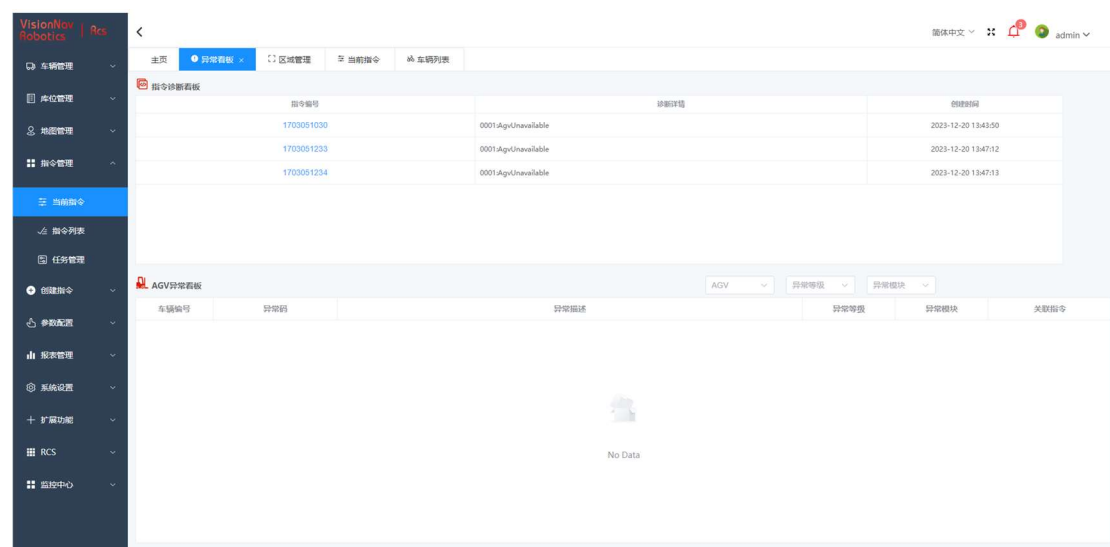
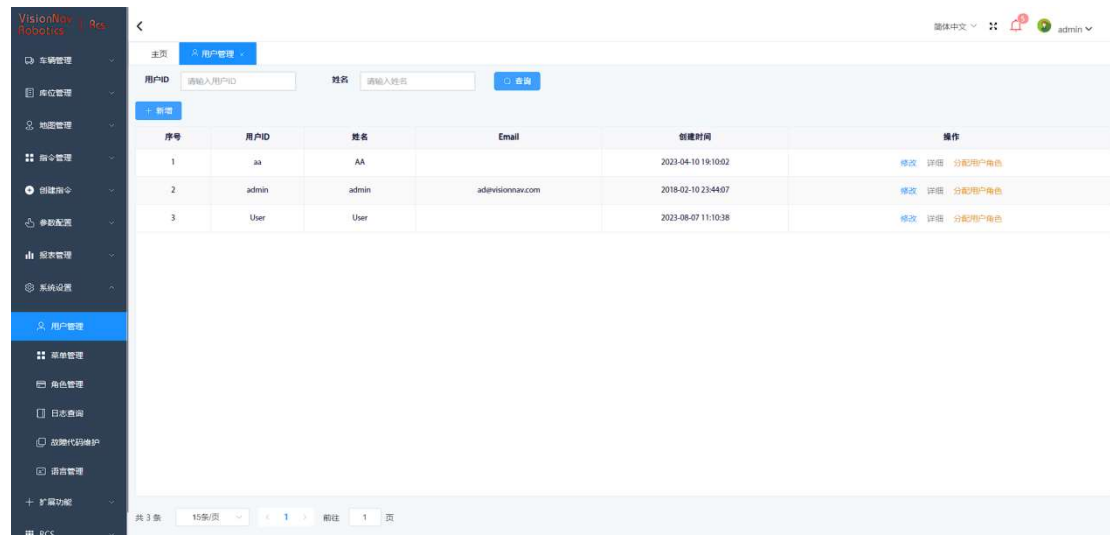


Figure 6.4 Instruction Exception Dashboard Page



Figure 6.5 Fault statistics page



序号	用户ID	姓名	Email	创建时间	操作
1	aa	AA		2023-04-10 19:10:02	修改 详细 分配用户角色
2	admin	admin	admin@visionnav.com	2018-02-10 23:44:07	修改 详细 分配用户角色
3	User	User		2023-08-07 11:10:38	修改 详细 分配用户角色

Figure 6.6 User Management Page

6.3 Network design of central control system

6.3.1 Network architecture of central control system

The central control system of Party B and external communication mainly include two aspects.

One is to communicate with the task initiating terminal. The task initiation methods include manual initiation, external system initiation, and external device signal triggering, corresponding to different task initiation terminals, depending on the business process requirements of this project. Different initiation methods require different networks and communication protocols, depending on the business process requirements of this project.

The second is to communicate with unmanned forklifts. The central control system is connected to the unmanned forklift using wireless LAN.

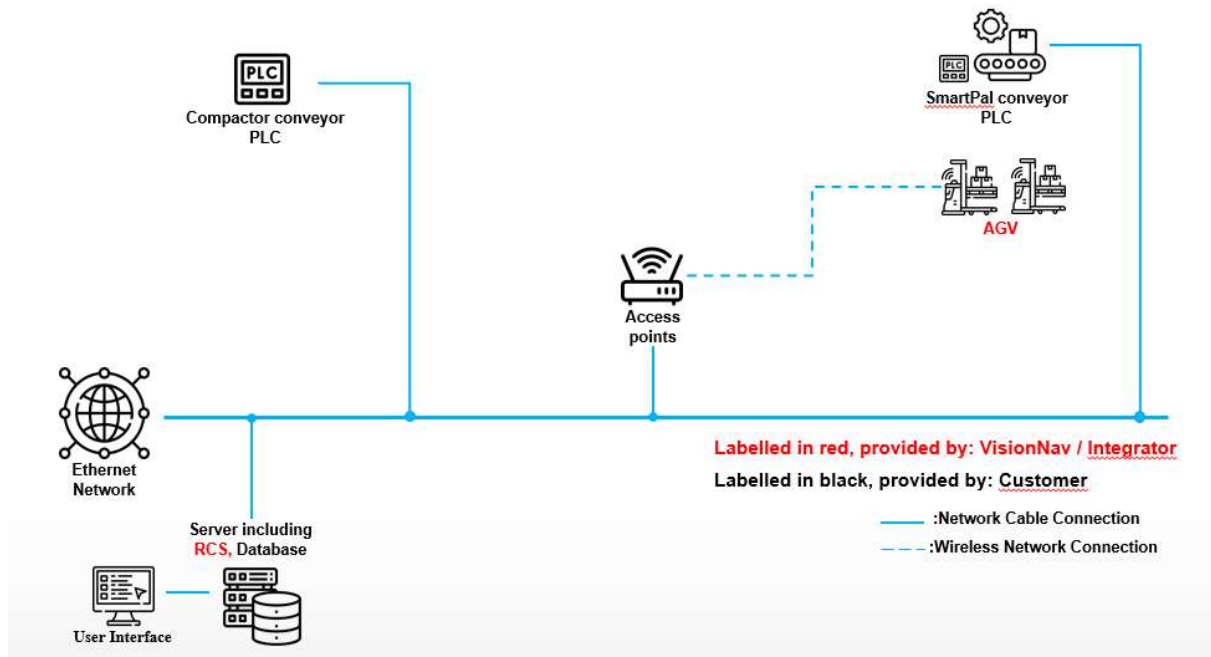


Figure 6.7 Overall network topology reference diagram of the central control system

6.4 Wireless network technical requirements

- The wireless network uses Customer's on-site network and must meet the following basic technical requirements:
- - Wireless access points (APs) supporting 802.11a/b/g/n protocols and 2.4G/5G networks.
 - Wireless network support for wireless roaming.
 - Full WIFI signal coverage in the operating area of AGV, with no blind signal areas.
 - Communication response times averaging 40ms or less.
 - Wireless coverage strength $\geq -70\text{dbm}$ and S/N (signal to noise ratio) $\geq 30\text{dbm}$ for AGV operating lines.
 - Test AGV access to the wireless network to run a continuous 30 minutes of ping package. The packet loss rate must be $\leq 1\%$ under the continuous ping packet of 1000 bytes / pkg, , and during the ping packet process, no more than 3 consecutive packet

losses can occur.

- Provide wired access to the central control server and the ability to communicate with AGV in the wireless network.
- In addition, to ensure high reliability of wireless communication, it is recommended to meet the following requirements.
- Wireless access point (AP) channel selection should be interleaved with other network signal channels to avoid co-channel interference.
 - Customer should provide an independent private network or separate SSID covering the whole site, which is within the same IP network segment and can be divided into specified VLANs. The network segment where the central control host is located should belong to the same segment with the AGV's specified SSID, and the AGV special VLAN or shared network segment should be isolated from the office network/business network, and access policies/internet authentication should not be configured in this segment to avoid blocking AGV communication packets and port communication.
 - For better wireless roaming, all wireless access point (AP) should be the same model.
 - All wireless access points (APs) are installed in an unobstructed location so that AP communication with AGV is not affected by obstacles such as metal.
 - Wireless access point (AP) devices should support at least 30 users, in order to avoid AGV access failed due to heavy AP access load. It is better if WLC could manage integrated.
 - For the situation that the warehouse area is complicated and the area is large, it is recommended to increase AP to ensure that the AGV does not lost connection in order to complete task smoothly.

6.5 System connecting interface

The central control system of Supplier can support docking with external systems Galys.

Table 2 Communication Protocol between Control System and External System

Index	Communication Protocol	Description
1	HTTPs	Using HTTPs messages and Get, Post methods for communication via REST API. Protocol between Galys and RCS.

The central control system of Supplier can support docking with external devices, such as conveyor lines.

The supported hardware communication protocols are as follows.

Table 3 Communication Protocol between Control System and External System

Index	Communication Protocol	Description
1	OPC-UA	The communication between RCS and Compactor PLC needs to be done via OPC-UA. RCS will be the client.
2	OPC-UA	The communication between RCS and SmartPal conveyors needs to be done via OPC-UA. RCS will be the client.

Remark: If Modbus TPC is used to connect to the device, the RCS can only be the master station.

6.6 System collection data security Instructions

The central control service will store log data and program running data on the server. The log data is used to record the prompt information during the execution of the service, which exists in multiple independent text formats, and is used to help troubleshooting and analysis when an exception occurs. The program runs the data is stored in the database, and the stored information includes order information, task execution information, vehicle and equipment operating status, and related necessary data.

The collection, use and storage of the above data by Supplier is essential for Supplier to provide services. Customer understands and agrees that Supplier can collect, use and store the data provided by Customer and/or generated during Customer's use of the services provided by Supplier. Customer agrees that Supplier can use Customer's data for purposes hereunder, including but not limited to providing services to Customer, improving and perfecting services, providing personalized or customized products and services, software upgrading and other purposes. Supplier shall have the right to analyze and make use of the overall data including Customer in accordance with law so as to provide better services for Customer.

System security design

7.1 Safety Scanner

The AGV is equipped with non-contact obstacle avoidance laser, when the obstacle enters the laser protection range, the vehicle will automatically slow down or stop immediately.

If the obstacle is out of the protection range at a certain time, the vehicle will start automatically and continue to carry out the task; if the safety protection of the vehicle is still in the triggering state after the pre-set time, the system will trigger the vehicle long time parking alarm, which needs operator confirmation before continuing the task to ensure the safety of the vehicle and personnel.

7.2 Safety Bumper

AGV is equipped with safety bumper. AGV can be stopped by the contact safety protection in extreme situations such as laser protection failed. Once the vehicle is safely stopped, the vehicle's tri-colour light flashes and alarm sound go off.

7.3 Emergency stop button

AGV body is equipped with safety emergency stop buttons at convenient locations for operators. When operators press the emergency stop button, the vehicle will stop immediately ensuring the safety of the vehicle and personnel.

7.4 Sound & Light Alarm

The system is equipped with sound and light alarm system. When the vehicle triggers a long-time parking alarm, the vehicle red light flashes and the alarm sound goes off; alarm audio can be configured according to the requirements of Customer.

AGV lit up the road in front by blue-colour light when running, which is used to remind head bent people who is for instance using mobile phone.

7.5 Operation in emergency and maintenance situations

Automatic mode: when the vehicle runs automatically under the control of the central control system, the manual operation of the forklift is invalid.

For manual operations under emergency, maintenance or special situations, manual mode can be turned with the use of the key and password; when the vehicle is in the manual state, not controlled by the central control system, the vehicle shall be operated by the handheld controller.

Under manual mode, buttons of reset, start, pause, manual/automatic switch, key switch may be used. Specific definitions and operations are as follows.

Start: starting AGV and resuming the tasks.

Pause: suspension of AGV and the task.

Reset: except for laser-triggered AGV stop, under other stop conditions, AGV can only continue to work after pressing the reset button to clear the failure and then pressing the start button.

Manual/automatic switch: a key type switch to switch between manual mode and automatic mode.

Key switch: power on/off switching for the main control box.

8. Implementation Plan and Guarantee Measures

Scope of Construction Works

NO.	Project	Content	Custom er	Supplier	Other
1	Power source	Primary wiring from the workshop substation to the equipment distribution cabinet.	▲		
2	On-site wireless network	Provide on-site wireless network and power distribution cabinet	▲		
3	Charger cable	The buyer provides 380V or 220V power distribution cabinet	▲		
		Charger power distribution switch	▲		
		The wiring from the charger to the charging station	▲		
		Charger installation and debugging		▲	
4	Information system	WMS	▲		
		Scheduling system		▲	
		Server installation	▲	▲	
		Server room power distribution	▲		
5	Navigation accessories	Navigation accessory installation		▲	
6	Equipment Shipping	Equipment transportation		▲	
		Unloading equipment provided	▲		
7	Equipment installation	On-site installation condition confirmation	▲	▲	
		Equipment installation		▲	
8	Equipment	On-site debugging		▲	

	debugging	Provide load test and commissioning supplies during acceptance	▲		
		Provide technical information required for acceptance		▲	
		Project implementation schedule		▲	
9	Training	Technical training for field equipment, technology, maintenance personnel and operators		▲	
10	Other	Install the required lifting equipment	▲		
		Electricity required for installation	▲		
		Provide working and living facilities to the Supplier's commissioning personnel during the work.	▲		

9. Quality Assurance and after-sales service

9.1 Warranty

Standard warranty period is 12 months, additional warranty prices and service can be provided upon request. Warranty period starts from Practical completion of the AGV System.

During the warranty period, VisionNav promises to provide customers the following service:

- (1) Troubleshooting support: remote support for problem solving within 8 hours by call or email
- (2) Defective parts replacement: free repair or replacement of product parts for quality problems arising from design, manufacture, transportation, and installation by the VisionNav, without any cost to the customers. There are additional 6 months extended warranty for new replacement parts.
- (3) Call back every 6 months for remote software health check.

If the product is damaged due to the following reasons (including but not limited to any reasons not related to the product or VisionNav), the warranty terms will not apply even within warranty period, and VisionNav will charge for maintenance and repair service:

- (1) Failure to operate equipment in accordance with the requirements of the equipment manual
- (2) Not operated and used in accordance with the installation or deployment environment, conditions and requirements specified by VisionNav
- (3) Self-disassembling or modification
- (4) Product damage caused by incorrect installation or improper maintenance
- (5) Product damage caused by users or third parties
- (6) Product failure or damage due to force majeure (e.g. earthquake, fire, lightning strike, voltage instability, etc.)
- (7) Use products for other purposes
- (8) Product repair and service not authorized by VisionNav
- (9) Perishable parts are also not covered by the warranty and customers are advised to purchase in advance for onsite spare part storage.

In addition, VisionNav shall not be liable for any damages caused by the foregoing reasons.

9.2 After-Sales Service and Support

A separate service and support agreement for after warranty period that may be applicable to Customer site is available upon request.

9.3 Training

VisionNav always adheres to the principle of customer first and service foremost to ensure that the products and services can be guaranteed, and the after-sale service of products and systems can play its due role. To facilitate customer to better use the system, VisionNav shall be responsible for providing technical training to the operators who manage and use the system during the installation and commissioning of the project and during the warranty period.

9.3.1 Training Subjects

Relevant personnel for operation and maintenance of AGV, including production personnel, technicians, management personnel, etc.

9.3.2 Equipment Installation and Commissioning Period

In the process of equipment installation and commissioning, customer's production, technical and managerial personnel may raise any questions about the equipment to VisionNav's technical

personnel, and VisionNav shall give detailed answers.

9.3.3 Equipment Warranty Period

Before the equipment is put into use and during the warranty period of the equipment, VisionNav will provide two free training on safety management and basic knowledge of equipment products, total training time (including on-site training) exceeds 8 hours.

After the training, both parties sign the «Equipment Operation and Maintenance Training Form» .

The training content includes:

NO.	Content	Requirements	Course hours
1	Equipment operating principle and function	Theoretical introduction	1h
2	Equipment operation and demonstration	Theoretical introduction and on-site training	2h
3	Common troubleshooting training	Explain the analysis and troubleshooting methods for common equipment malfunctions	2h
4	Equipment maintenance	Theoretical introduction and on-site training	2h
5	Equipment safety and other precautions	Explain the precautions for safe operation and operation of equipment	1h

10. Acceptance Terms

Products provided by Supplier must be tested and accepted according to the procedures stipulated in this documentation.

10.1 Factory Acceptance Test (FAT)

Before the products leave the factory, Supplier should conduct tests and inspections on the quality, specifications, performance, quantity, and weight, and issue a factory inspection report.

10.2 Arrival Inspection

After products are delivered to the designated location, both Supplier and Customer shall count and inspect the packaging, appearance, and number of the packed pieces according to the shipping bill and packing list and go through the handover procedures. Products must meet below requirement:

- Good appearance, no damage during transportation.
- The name, specification, and quantity are consistent with the goods specified in the contract supply list.

10.3 Open-Package Inspection

- After arrival inspection, Supplier and Customer shall open the package for inspection according to the contract requirements and packing list.
- Customer shall notify Supplier of the inspection date ten days before open-package inspection. If Supplier fails to arrive on time, within 3 days after Customer's written reminder, Supplier still fails to arrive for open-package inspection without reasonable reasons, Customer has the right to unpack and inspect the goods by themselves, and the inspection results and records are equally valid for both parties to the contract.
- If the goods arrive at the site of Party A for 3 days without opening the box and no objections are raised, it shall be deemed that the opening inspection is qualified.
- If the quantity, specification, model and appearance are found to be inconsistent with the contract supply list or technical specification during the open-packaging inspection, or the goods under the contract are short-packed and damaged, Customer shall record and require signature confirmation from Supplier.
- If the repair, replacement, or replenishment occurs during the inspection due to the reasons of other parties or Customer, both parties to the contract shall sign an agreement through negotiation and handle the agreement according to the agreement. If Customer is responsible for such circumstances, Customer shall bear the corresponding responsibility.

- Costs for Supplier's representative to attend arrival inspection and inspection, including airfare and living expenses, shall be negotiated between Customer and Supplier.
- After the open-package inspection is qualified, the representative of Supplier and Customer shall sign the open-package inspection report.

10.4 Installation, Deployment

AGV installation, deployment and commissioning on-site are undertaken by VisionNav and carried out in the presence of Customer personnel.

In the process of AGV installation, deployment and commissioning, if any defects are found in the goods supplied by VisionNav, Customer should notify VisionNav in time, and VisionNav must handle it.

10.5 Testing and Commissioning

The testing and debugging of the goods on site shall be carried out by Supplier in the presence of Customer's personnel.

In the process of testing and debugging of the goods, if the goods are damaged or defective, Customer shall notify Supplier in time, and Supplier must deal with them.

10.6 Final Testing and Acceptance

The equipment provided by VisionNav will be accepted after normal operation for 7 days. Customer shall not refuse to organize project acceptance for any reason. (Definition of normal operation: the AGV system works in a normal environment without hardware damage or safety accident; AGV positioning failure, obstacle triggering anti-collision bar, scanner covered by dust, charging failure and other simple problems that can be quickly solved manually are not included.)

If VisionNav does not receive the payment due from Customer within the time specified in the contract between the two parties, VisionNav has the right to interrupt the service.

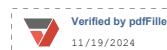
Final acceptance is subject to the terms of this technical agreement.

If 6 months after the AGV enters the site, Customer still fails to activate or accept it, this incident is not caused by Supplier, and the project is considered to have passed the acceptance.

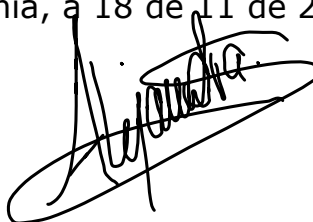
Customer and Supplier have duly executed this Agreement as of the Effective Date.

Relación de documentos

(_) Memoria NN páginas
(X) Anexos 103 páginas



La Almunia, a 18 de 11 de 2024



Firmado: Alejandra Valeria Suárez Siancas