



UNIVERSIDAD CARLOS III DE MADRID
INGENIERÍA ELECTRÓNICA INDUSTRIAL Y AUTOMÁTICA
OFICINA TÉCNICA 23-03

**Instalación eléctrica y automatización de una
fábrica de complementos alimenticios**

Ingenieros:

David Antón Sánchez, colegiado:100283214

Alvaro Ferrán Cifuentes, colegiado:100282637

Revisado por:

Catalina de Aragón

Facha: Fecha de entrega

Índice

I Memoria	3
1 Objetivo	3
2 Ubicacion	3
3 Antecedentes	3
4 Normativa	3
4.1 REBT	3
4.2 Código Técnico de la Edificación	3
4.3 Normativas relativas a complementos alimentarios	3
4.4 Normativas de seguridad y salud	3
5 Descripción general	3
6 Elementos del sistema	4
6.1 Instalación eléctrica	4
6.2 Maquinaria	4
6.2.1 Máquina de secado de polvo	4
6.2.2 Máquina de compresión en tabletas	4
6.2.3 Máquina de verificación de dureza de tabletas	4
6.2.4 Máquina de revestimiento de tabletas	4
6.2.5 Máquina de sellado de blisters	4
6.2.6 Máquina de fabricación de cajas	4
6.2.7 Máquina de empaquetado	4
6.2.8 Robot de paletizado	4
7 Sistema propuesto	4
8 Flujograma	5
9 Anexos	5
9.1 Anexo de cálculos:	5
9.1.1 Cálculos de la Instalación eléctrica	5
9.1.2 Cálculo de las instalaciones de automatización	6
9.1.3 Instalaciones de seguridad	6
9.2 Anexo de código	6
9.3 Anexo de catálogos	7
9.3.1 Máquina de secado de polvo	7
9.3.2 Máquina de compresión en tabletas	8
9.3.3 Máquina de verificación de dureza de tabletas	9
9.3.4 Máquina de revestimiento de tabletas	10
9.3.5 Máquina de sellado de blisters	11
9.3.6 Máquina de fabricación de cajas	12
9.3.7 Máquina de empaquetado	13
9.3.8 Robot de paletizado	14
9.4 Planificación	14

II	Planos	15
III	Pliego de Condiciones	16
IV	Presupuesto	17

Parte I

Memoria

1 Objetivo

El objetivo de este proyecto es automatizar una fábrica de pastillas de complementos alimenticios.

En este documento se especificarán los procesos necesarios para tal fin, las condiciones que deben cumplir los mismos, así como los planos para el correcto posicionamiento de las máquinas y el presupuesto con el coste aproximado del proyecto.

2 Ubicacion

La fábrica se encuentra en Calle de la Fundición 8, Rivas-Vaciamadrid, Madrid, España.

3 Antecedentes

La propiedad ha adquirido la nave industrial tras la quiebra de un supermercado y ha contactado con esta ingeniería para realizar un proyecto de instalación de una fábrica de comprimidos. La nave mide ????????? metros de largo por ????????? metros de ancho, con una superficie útil de ????????? metros cuadrados. Incluye asimismo un espacio de oficina de dos niveles. Todo el recinto está dotado de los sistemas de ventilación y seguridad requeridos por la legislación vigente.

4 Normativa

4.1 REBT

Se sigue el Reglamento Electrotécnico de Baja Tensión

4.2 Código Técnico de la Edificación

4.3 Normativas relativas a complementos alimentarios

4.4 Normativas de seguridad y salud

5 Descripción general

El recinto tiene una superficie de ????????? metros cuadrados, incluyendo la nave con las oficinas y un espacio de maniobra para camiones. La nave tiene una superficie útil de ????????? metros cuadrados y se divide en tres zonas distintas: zona de carga y descarga de materiales, zona de almacenamiento de materia prima, zona de almacenamiento del producto finalizado y zona de máquinas donde se realiza el proceso de fabricación.

Los camiones entran por en el recinto y tras maniobrar en el espacio habilitado para ello entran marcha atrás en la nave, donde los empleados procederán a descargarlo con la ayuda de toros mecánicos. Los sacos con la materia prima en polvo, así como los cartones para ensamblar las cajas, se almacenan en estanterías de palés situados delante del inicio del proceso.

En la zona de máquinas se lleva a cabo todo el proceso de transformación del polvo a cajas de pastillas. Contiene un horno de polvo, una máquina de compresión, una máquina de pruebas, un tambor de revestimiento, una máquina de formación de blisters y una última de embalaje, así como cintas para transportar los distintos elementos y dos brazos robóticos para colocar el producto final. El producto final se almacena en palés en estanterías cerca de la puerta para agilizar el proceso de carga del camión y por tanto perder menos tiempo.

El espacio de oficinas consiste de una recepción y un centro de control en la planta baja y un despacho y puestos de trabajo en el segundo nivel. Ambos pisos disponen de baños.

6 Elementos del sistema

6.1 Instalación eléctrica

6.2 Maquinaria

6.2.1 Máquina de secado de polvo

6.2.2 Máquina de compresión en tabletas

6.2.3 Máquina de verificación de dureza de tabletas

6.2.4 Máquina de revestimiento de tabletas

6.2.5 Máquina de sellado de blisters

6.2.6 Máquina de fabricación de cajas

6.2.7 Máquina de empaquetado

6.2.8 Robot de paletizado

7 Sistema propuesto

Cuando el horno emita una señal de aviso un operario procederá a llenar el depósito de dicho horno con la materia prima. Una vez lleno, el horno libera el polvo uniformemente sobre una cinta transportadora. Esta lo transporta por el horno de manera ondulante para eliminar cualquier tipo de humedad.

A la salida del horno el polvo es introducido en una máquina de compresión, donde es convertido en pastillas y se le imprime el nombre de la pastilla. Acto seguido pasa por una máquina de comprobación, que desecha cualquier pastilla que haya resultado demasiado frágil por seguir húmeda tras el horno. Las pastillas desechadas, se trituran y depositan en un recipiente para que el operario lo reintroduzca en el horno en la siguiente iteración.

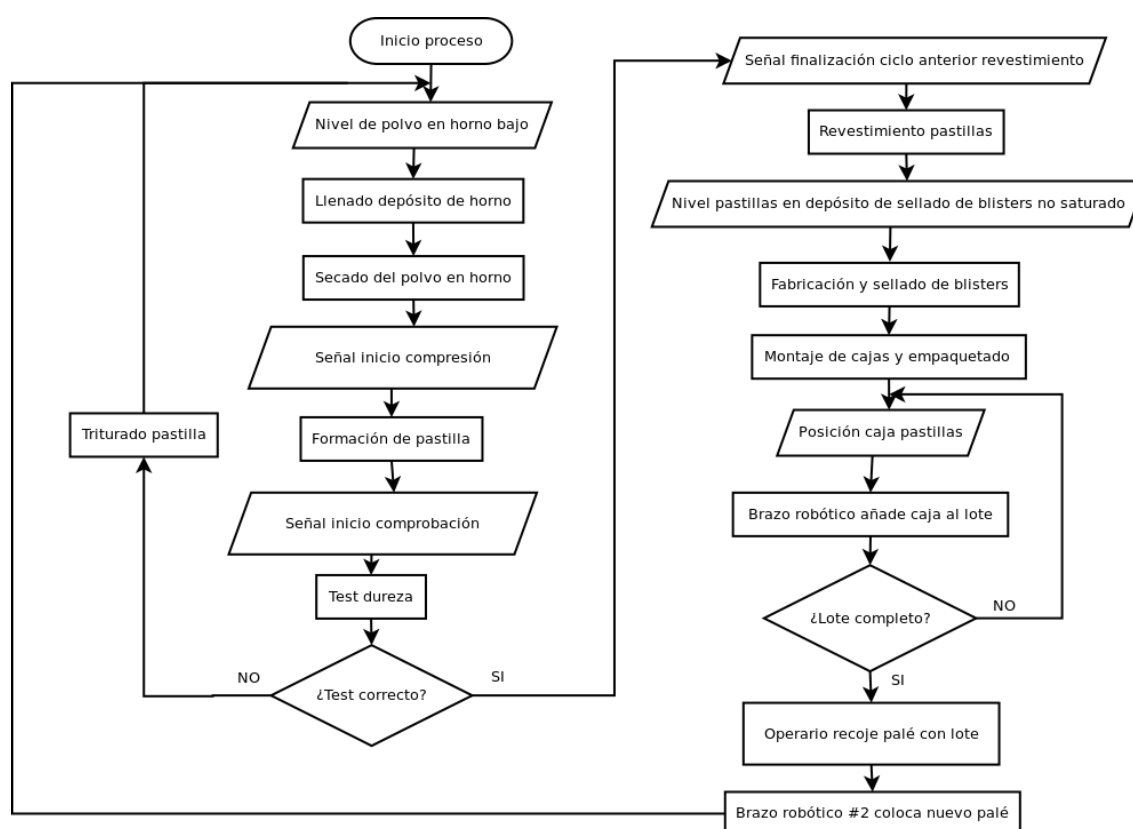
El resto de pastillas continúa hasta un tambor donde se les da un revestimiento de agua con colorantes para su identificación y conservación, al endurecer así la capa exterior y evitar que se deshagan. Tras ser rociadas por pulsos muy rápidos y cortos para favorecer un secado rápido son transportadas a una máquina de sellado.

En esta máquina se dejan caer pastillas hasta llenar un depósito, donde mediante un sensor indica el llenado. La selladora coloca las pastillas en posición según la matriz utilizada. Paralelamente tira del rollo de plástico en lámina y lo coloca debajo de la parte superior. Al bajar, ésta deforma la lámina con unos cabezales calientes y crea los habitáculos donde

inmediatamente inserta las tabletas. Acto seguido se corta el plástico y este avanza a la siguiente posición donde se le coloca una lámina de aluminio con el logo impreso y es sellado por calor al bajar la parte superior en la siguiente iteración.

Finalmente se transportan los blisters sellados por otra cinta transportadora a la máquina de empaquetado, que coge las cartulinas de las cajas y las dobla para darles su forma final e inserta los blisters en la caja, así como un folleto explicativo previamente impreso y doblado. Las cajas con el producto final se dejan caer por una rampa hasta una mesa donde un brazo robótico equipado con una cámara coge las cajas individuales y las coloca en cajas de lotes en un palé para ser recogido por un operario y almacenado en una estantería. Un segundo brazo robótico coje un palé de una pila de palés vacíos y lo coloca en la posición del anterior.

8 Flujograma



9 Anexos

9.1 Anexo de cálculos:

9.1.1 Cálculos de la Instalación eléctrica

Diseño del cuadro general de protección y mando

Cálculo de las líneas de alimentación de cada máquina

Cálculo de las líneas para las tomas de corriente de uso general

Cálculo de las líneas para las tomas de corriente con SAI

Cálculo de las líneas para iluminación

Cálculo de las líneas para iluminación de emergencia

9.1.2 Cálculo de las instalaciones de automatización

Sensores

Cuadro centralización de automatización

Rack con PC industrial conectado a la red de la fábrica

9.1.3 Instalaciones de seguridad

Protección de las personas

Protección contra intrusión

9.2 Anexo de código

9.3 Anexo de catálogos

9.3.1 Máquina de secado de polvo

Quick Details

Condition:	New	Type:	Fluid Bed Drying Equipment	Place of Origin:	Jiangsu China (Mainland)
Brand Name:	ligan	Model Number:	5-500	certificate:	ISO9001:2008
material:	SS304/SS316	input capacity:	5-500KG/BATCH	power:	1.5-45KW
steam consumption:	120-600kg/h	steam compressure:	0.2-0.6Mpa		

Specifications

the dryer is widely used in powder drying and granules drying, for chemical industry, pharmaceutical industry, foodstuff industry

Detailed Product Description

GFG High Efficiency Fluid Bed Dryer is mainly used to dry powder and granule products in food and pharmaceutical industry.

Applications

This batch type fluid bed dryer is specially designed for drying powder and granule products with good flowability in food and pharmaceutical industry

Principle

Operation principle: after being heated and filtered, the fresh hot air will be blew into the air distributor at the bottom of the machine and



penetrate through the meshed trolley which

loaded with wet materials. Under the effect of air-flow and agitator, the wet material will be fluidized. During the fluidization, the moisture will be rapidly evaporated. At the top of dryer, filter bags are fixed to separate dusts from the exhausted gas. And the filter bags will be regularly cleaned by compressed air blows. At the exhaust vent, a silencer is combined to lower the noise.

Features

- 1. Easy and convenient temperature control:** The drying temperature is controlled by temperature sensor which makes it very easy to control and display the drying temperature through the control panel.
- 2. Perfect fluidization:** With the special designed agitator, the fluidization is perfect and without dead corner.
- 3. Wide application scope:** The application scope is extensive and its drying efficiency is relatively high.
- 4. Good compatibility:** It can be used to dry sticky granules with wide granule size distribution.
- 5. Sanitary working condition:** The whole machine body is compact and easy to clean, operate and install. Its working condition can meet the GMP standard.
- 6. Enhanced drying capacity:** Because of perfect fluidization, the drying time is considerably reduced.

Technical parameters:

technical items		Model						
Load capacity (kg/ batch)		60	100	120	150	200	300	500
fan	air volume(m ³ /h)	2361	3488	4000	4900	6000	7800	10800
	air pressure(mmH ₂ O)	594	533	533	679	787	950	950
	power(kw)	7.5	11	15	18.5	22	30	45
stirring power(kw)		0.55	0.55	0.55	0.55	0.55	0.75	0.75
stirring speed(r/min)		11						
consume of steam(kg/h)		140	170	170	240	280	360	450
time of operation(min)		15-30 by mains of different raw material						
height of main machine	round(mm)	2700	2900	2900	2900	3100	3600	3850

9.3.2 Máquina de compresión en tabletas

Basic Info.

Model NO.: YUJ-17BZ	Finished Dosage Form: Round Granulator
Type: Pill Medicine Making Machine	Certification: CE, GMP, ISO, SGS
Name: Chinese Traditional Pill Making Machine(Yuj-17B)	Specification: D3-12
Productivity: 5-50kg/H	Motor Power: 4kw
Control: Button Control	Medicine Shape: Round, Heart, ...
Voltage: 380V 50Hz	Material: Stainless Steel 304
Gw: 500kg	Size: 1250*750*1100mm
Export Markets: Global	

Additional Info.

Trademark: HuaYuan	Packing: Exported Package
Standard: CE, ISO	Origin: China
Production Capacity: 500 Unit/M	

Product Description

YUJ-16B Fully-Automatic&Contolling-speed Traditional Chinese Medical Making-Pill Machine Group(Patente Product)

Main application:

Watered pill/water-horny bolus/honeyed bolus/condensed pill/Tibetan medical pill etc.

Structural features:

1. PLC controller with fast speed.
2. Imported inventor, stable and high quality.
3. Touch screen man-machine interaction, easy operation.
4. Machine made by stainless steel, good seal, no blind corner, easy to clean.
5. Easy disassembled and cleared up.
6. Accords to GMP certification standard



If you have any question, feel free to contact with me, I am here looking forwards to your inquiry.
Cell: +8613810983151

specification	productivity	motor power	total weight	external dimensional	notes
Φ3-12	5-50kg/h	4kw	round 100kg	1250*750*1100	PLC control

9.3.3 Máquina de verificación de dureza de tabletas



Basic Info.

Model NO.: YJX-220B

Type: Medicine Detecting Instrument

Capacity: 120000PCS/Hour: Electrical
Connection: 220V/50Hz

Finished Dosage Form: Capsule

Certification: ISO

Export Markets: Global

Additional Info.

Trademark: PF

Origin: ISO

Production Capacity: 120000capsules/Hour or 50kg Tablets

Packing: Export Standard Wooden Case

HS Code: 9031809090

Product Description

Description

YJX-220B model drug inspecting machine is a new product researched by our company on the basis of integration of domestic and foreign advanced technologies in order to meet the needs of pharmaceutical sector. It can test outlook quality for hard capsules, soft capsules and tablets.

Work Principle

The products enter into the vibrating deeder through the bunker, and then enter into the rotating roller in single. On the feeding tray is a screen mesh that can get rid of the pellets and chips in the product. Under the feeding tray is a power collecting box that can recycle the operator. And thus the operator can easily select the unqualified product out from them. The foot switch can stop the delivery belt at any time. The medicines still keep overturning while the delivery belt is stopped, which won't affect the testing process. There is an adjustable mirror that can help the operator select the unqualified product at the other end. As the vacuum system is applied, it needs not to connect a vacuum pump outside. There is no blind angle and fade zone in its design. As a result, it can assure the products can be tested in all directions.

The rotating speed for roller can be adjusted alone. It won't be affected by the testing speed. It is a good equipment.

Technical parameters:

Scope of application	Inspection of hard or soft capsule plain or coated tablets and other round or cylindrical objects. Min tablet thickness: 3mm)
Output	Up to 120000 capsules/h or approx. 50kg tablets, depending on product & product size)
Electrical connection	220V/50hz, single phase or 110V/60Hz, single phase
Overall dimension	1400*650*1250(H*L*W)mm
Power input	0.6Kw
Weight	125KG
Compressed Air	6bar

9.3.4 Máquina de revestimiento de tabletas



Basic Info.

Finished Dosage Form: Tablet

Type: Preparation Machinery

Certification: CE

Export Markets: Global

Additional Info.

Trademark: UNIMACH

Packing: Packed in Export Wooden Case

Standard: GMP, CE

Origin: China

Production Capacity: 300sets/Year

Product Description

Applications

It can be widely used for coating various tablets, pills and sweets with organic film, water-soluble film and sugar film etc.

Characteristic:

1. All operations can be finished through pushing the touch key on the computer-controlled panel. The operational panel is a full-sealed slight touch film interface. The main machine has reliable and stable performance.
2. The streamline guiding-type mixer drives tablets to make easy and smooth rotation without fragment and chipped edge, which improves the quality of finished products.
3. Automatic feeding device stopped the cross pollution, convenient to feed, with high efficiency and full direction. The coating boiler equipped in the high pressure spray gun, which can rotate 1800, there set a cleaning sprayer at the air exhaust exit and hot air mouth, which can be rotated in automatic and full direction, without dead corner more convenient to clean.
4. Select the imported Japan ANEST IWATA spray gun. It's convenient to operate and easy to master and flexible controlled technological requirement. The spray gun head requirement must keep in the range of 0.29 MPa to 0.39 MPa.
5. Angle and sector can be adjustable, uniform density and particle in spray pressure and 0.4-0.5MPa in atomization pressure that avoid the dropping leakage and blockage phenomenon of size, uniform atomization and large spray area, practical to adjust flow, free leakage and blockage, angle and sector.
6. Film coating machine contains the mechanical device of cauldron wrapping little material can coat at least 20kg plain pills in 150 type coating machine, regulate through it inherent machinery, make a small mount of medium coat in cauldron and will not cause the wasted of dressing and greatly improve the scope of appliance.

Item/model	BGB1000	BGB600	BGB400	BGB150	BGB80	BGB40	BGB10
LoadingCapacity (kg/batch)	1000kg	600kg	400kg	150kg	80kg	40kg	10kg
Drum Revolution (r/min)	2.0-12rpm	2.0-12 rpm	0-13rpm	2.1-14 rpm	2.0-16 rpm	2.0-18 rpm	3.0-19 rpm
Main Machine Power	7.5KW	4KW	3KW	2.2KW	1.5KW	1.1KW	0.55KW
Diameter of coating drum	1800mm	1580mm	1580mm	1200mm	930mm	780mm	500mm
Power of air exhaust cabinet motor	11KW	11KW	7.5KW	5.5KW	3KW	2.2KW	0.75KW
Air exhaust flow	18000m3/h	15450 m3/h	10000m3/h	7419 m3/h	5268 m3/h	3517 m3/h	1285m3/h
Power of hot air cabinet motor	7.5KW	4KW	2.2KW	1.5KW	1.1KW	0.75KW	0.37KW
Hot air flow	10650 m3/h	6500 m3/h	3517 m3/h	2356 m3/h	1685 m3/h	1285 m3/h	816 m3/h
Weight of main machine	2000 kg	1600 kg	1000 kg	850 kg	600kg	500kg	200kg
Clean air	Pressure	0.4MPa	≥0.4MPa	≥0.4MPa	≥0.4MPa	≥0.4MPa	≥0.4MPa
	Air consumption	2.5m3/min	2 m3/min	1.5 m3/min	0.7 m3/min	0.35 m3/min	0.2 m3/min

9.3.5 Máquina de sellado de blisters



Basic Info.

Model NO.: DPK-260H2

Finished Dosage Form: Tablet

Type: Pharmaceutical Packaging Machinery

Certification: GMP

Additional Info.

Trademark: UNIMACH

Packing: Packed in Standard Export Wooden Case

Standard: GMP

Origin: China

Production Capacity: 200sets/Year

Product Description

Purpose

DPK-260H2 automatic ALU-PVC and ALU-ALU blister packing machine is our latest improved equipment, adopts inverter control and integrated mechanical, electrical, optical, pneumatic control technology. Its innovative design meets pharmaceutical industry (GMP) standard strictly, is leading in China, this machine has features such as advanced function, simple operation, high output, is the most ideal packaging equipment in large and medium size pharmaceutical enterprises, healthcare products and food industry.

Performance features

- (1) adopt Siemens PLC programmable control, wonderful touch screen operation, frequency control, servo with speed reducer traction, traction length may be adjusted at will on the touch screen within the scope of technical parameters, could avoid errors caused by manual mechanical adjustment, reduce labor intensity and waste of consumables greatly;
- (2) have functions such as heating temperature control detection, control, uniform die heating, host overload protection, PVC and PTP packing material level detection and alarm shutdown, automatic diagnosis alarm prompt for equipment fault and automatic shutdown protection;
- (3) feeder adopts steam vibration feeding and bunker level detection control, reduce long time mixing friction of materials greatly, so as to protect material integration;
- (4) level detection device is installed for feed hopper, if level is insufficient, host will prompt and enter shutdown status, ensure feeding integrality of each plate, increase product qualification rate;
- (5) stations of the complete machine adopts fast loading structure design, suitable for multi-variety production, dies may be replaced more conveniently and reliably (only about 30 min is required from replacing die to production);
- (6) contact heating, positive pressure formation, air cushion heat seal for female/male checkered plates;
- (7) adopt special processing and assembly process to ensure balanced running of aluminum foil without offset or jitter, promote more accurate, stable alignment of graphic text;
- (8) have two enlarged PVC bearing platforms for fast replacement, overall guide rail for the complete machine, could enhance practicability of the complete machine;
- (9) rectangular design, "T" positioning of the die facilitate die replacement, all parts that contact with medicaments are made of high quality stainless steel and high quality aluminum alloy, top grade surface treatment process highlights tactile sensation;
- (10) have automatic scrap rolling mechanism, scrap may be collected easily, finished products are output orderly, conveyor belt is provided at the outlet to provide necessary conditions for follow-up equipment and production;
- (11) one machine dual purpose, aluminum-plastic or aluminum-aluminum varieties may be produced only by replacing a small part of structure;
- (12) the complete machine adopts split connection design, could enter elevators, workshops easily.

High Speed ALU-PVC/Alu-Alu Blister Packing Machine (DPK-260H2)

High Speed ALU-PVC/Alu-Alu Blister Packing Machine (DPK-260H2)

9.3.6 Máquina de fabricación de cajas



Basic Info.

Export Markets: Global

Additional Info.

Trademark: AOKE

Packing: Wooden Box

Standard: ISO9001, 2000

Origin: Shanghai

Production Capacity: 30sets/Month

Product Description

1. Oscillating cutting function: Cut a variety of materials(corrugated board, cloth, paper board, fiber board, plastic board, ect)
2. Creasing&folding function: Satisfied creasing line available on corrugated board, craft paper, plastic board, etc.
3. Dotted line cutting function: Dotted line cutting available on different materials for folding
4. Half cutting function: Half cutting available for folding on different materials
5. Drawing function: High precision drawings available
6. Position resgistration system: Position resgistration available by laser light
7. Draging tool function: Thin material cutting available in draging tool

Max speed: 1000mm/s

Max cutting thickness: 15mm

Min cutting diameter: 6mm

Overlapping precision: $\leq 0.1\text{mm}$

Vacuum: 5.5KW

Control&driver: Servo motor

Data port: ISA port

Input cushion: 32MB

Data form: HPGL

Data transfer speed: 10MB/S

Voltage: 220V \pm 10%50Hz

9.3.7 Máquina de empaquetado

Product Description

Multifunction Automatic High speed Boxing Machine 多功能高速自动装盒机



Usage:

This Machine is suitable in a lot of fields. It can insert blisters, bottles, vials, tube, ointment, sachets, injections, cosmetics, condom, ampoules, plow-wrapped products, soap Components, automotive parts, hardware, frozen food, milk powder bag, cereal bag, pharmaceutical products into carton.

It is high technology product which incorporates pneumatic-photo-electro-mechanic.

Automatic Cartoner Machine finishes running by a series of photo-electro controller to make the machine stability and guarantee the packing quality. It includes 1to 4folds leaflet automatic folding, cantons in suction and open, products and leaflet put into, printing batch number, sealing or option hot-glue device. The machine can be single used or linked with Filling Machine, Blister Packing Machine, Shrink Machine, Three Dimensional Packaging Machine, etc to form a production chain.

Features:

1. International famous brand of electric components such for PLC touch screen, frequency inverters, etc.
2. Adopt human-machine operation system.
3. Automatically displaying device for trouble, speed and finished products counting
4. Machine running without pressing if no products or incorrect position of products. And stopping automatically if incorrect position of product into carton after return or no cartons or out of leaflets continuous.
5. No products not suction leaflet, no leaflet not suction carton.
6. Automatic detection and rejection device for lacking blister goods and leaflets.
7. Protecting automatically for overloading.
8. Stable performance, operation is easy.
9. High speed production rate, it can carton almost 200 pcs boxes per minute at its maximum rate.

High Speed Multifunctional Automatic Cartoning Machine (HTZ200)

9.3.8 Robot de paletizado

9.4 Planificación

Parte II

Planos

planos

Parte III

Pliego de Condiciones

pliego

Parte IV

Presupuesto

presupuesto