SKLN SERIES

COUNTERFLOW COOLER

OPERATION MANUAL

ZTMT
ZHONGTIAN AGRO

江苏中天农牧机械有限公司

JIANGSU ZHONGTIAN AGRO MACHINERY CO.,LTD

Important instruction:

1 This manual detailedly describes SKLN series counterflow cooler of each system structure, function and use and maintenance method. Before installation and use of the machine , customer should read the manual,and have a full understanding of the ministries and its structure and function ,then have operation and maintenance of the machine. Due to the continuous improvement of product structure, after a certain time period, the manual of narrative content and the actual situation of the products will have small changes.Users should pay attention to it.

2 Please propose your advice to us for melioration when finding quality problem or others.Thanks !

Ⅰ. USE, APPLICABLE SCOPE AND PERFORMANCE FEATURES

1. Use and Applicable Scope

The cooling of pellet feed is an indispensable process in the feed pelleting section. It cools the pellet feed coming from pellet mill and with a temperature of 70℃～90℃ to a temperature 3℃～5℃ slightly higher than ambient temperature, and is capable of lowering to a safety moisture content (≤12.5%), which facilitates the transportation and storage of pellet feed.

Counterflow cooler of different models are with different capacity, applicable in feed mills of various scale.

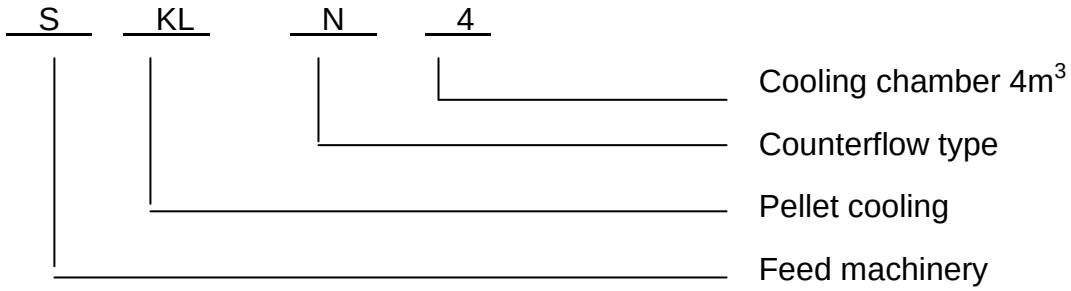
2. Performance Features

Counterflow Cooler is a new type cooler prevails internationally at present; it cools the pellets with high temperature and high moisture by using the principle of counterflow cooling, i.e. the ambient cool air go through the pellet layer vertically, first contact with cooled pellet, then the gradually warmed air contact with hot pellet, the air flow direction is opposite with that of pellet flow, so making the pellets be cooled gradually in turn, avoiding cool air directly contact with hot pellets to make pellets cool rapidly with a result of crack of pellet surface usually caused by other types of cooler. Since the cool air goes into the cooler from the bottom in all directions, with large air-in area, and high utilizing efficiency of cool air, so the cooling effect is remarkable. Moreover, this machine is low in energy consumption and convenient in operation. So counterflow cooler is a new generation product with advantage compared with previous vertical, horizontal cooler.

Ⅱ. MAIN TECHNICAL PARAMETERS

1. Meaning of Type

SKLN4 Counterflow Cooler



2. Main Technical Parameters for Different Types (see Table 1)

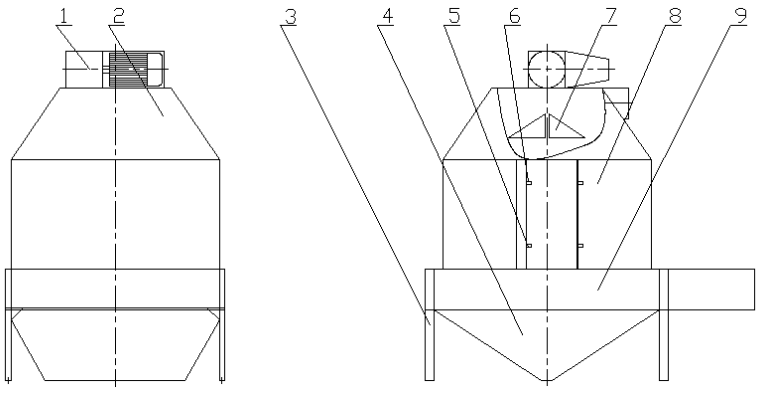
Table 1

Model / Parameters	SKLN1.5	SKLN2.5	SKLN4	SKLN6	SKLN8
Cooling volume m^3	1.5	2.5	4	6	8
Capacity t/h	3	5	10	15	20
Cooling time	No less than 6～10 min.				

Feed temperature after cooling	Not more than +3～5℃ above ambient temperature				
Volume of air aspiration m3/min.t	28～34				
Drive power KW	1.1	1.5	2.2	3	3
Airlock power KW	0.75	0.75	1.1	1.1	1.5

Ⅲ. MAIN STRUCTURE AND WORKING PRINCIPLE

See Figure 1 for the structure of Counterflow Cooler. It mainly consists of airlock feeder, air outlet top cover, rhombic taper spreader, cooling bin, high and low level indicator, reducer brake motor, eccentric transmission sliding valve discharging mechanism, fixed frame adjusting device, hopper, machine frame and aspiration system etc. The process is as follows: Pellet feed with high temperature and high moisture coming from pellet mill passes through the airlock feeder and rhomb taper spreader evenly spread onto the cooling bin. Cool air comes inside the cooling bin through the gap between the sliding valve discharging mechanism bottom and the hopper top locates under the bottom part of cooler, and vertically passes through the pellet layer conducting the heat exchange with moisture and hot pellet, then aspirated out by the aspiration system, so the pellet get cooled. The cooling time is controlled by the position of high and low level indicators, when the pellet layer reaches the high level indicator, the motor starts discharging material, when the pellet layer goes below the low level indicator, the motor stops and stop discharging pellet. After the motor stops, the relative position of sliding grid and fixed grid of the sliding valve discharging mechanism is controlled by brake motor with limit switch, so ensures no pellet leakage after stops discharging. The sliding valve discharging mechanism is assembled at the bottom of cooling bin, it does reciprocal movement controlled by reducer brake motor through eccentric mechanism, changes the relative position of sliding grid and fixed grid to get the pellet discharged from cooling bin, and discharged from hopper finally.



1. Airlock feeder 2.Air outlet top cover 3.Machine frame 4.Hopper 5.Low level indicator 6.High level indicator 7. Rhomb taper spreader 8.Cooling chamber 9.Reducer brake motor

eccentric transmission sliding valve discharging mechanism

Figure 1 Counterflow cooler structure

The flow direction of pellet and air see Figure 2, pellet flows downwards, while air comes in from the bottom of cooling chamber, and aspirated out of the cooler top outlet and goes out through ducting, cyclone and fan.

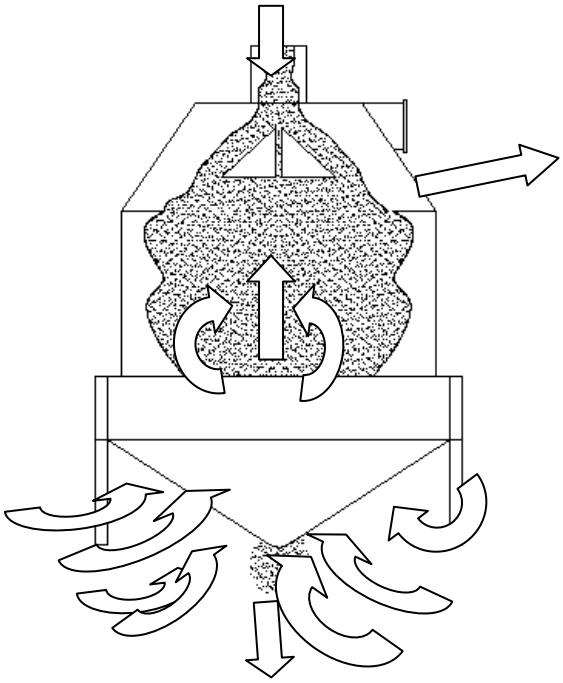
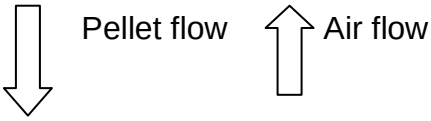


Figure 2 Flow direction of pellet and air



1. Rhomb Taper Spreader

Rhomb taper spreader serves to spread and make the pellet feed evenly accumulate in the cooling bin. It mainly consists of two half rhomb taper bodies and support. See Figure 3 for its structure. Pellet feed can be spread from four sides and the middle of the rhomb taper spreader. The distance between two half rhomb taper bodies is adjustable to change the spreading area of feed, and make the pellets evenly spread into the cooling bin.

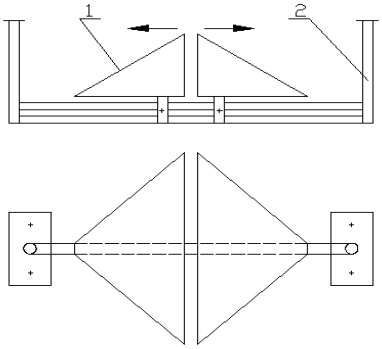


Figure 3 Rhomb taper spreader

1. Half rhomb taper 2. Support

2. Slide Valve Type Discharging Mechanism

The slide valve type discharging mechanism mainly consists of spacing grid, sliding grid, fixed grid, limit switch, limit block, reducer brake motor, eccentric transmission mechanism, and fixed grid adjusting mechanism. See Figure 4. The sliding grid in the middle layer is driven by reducer motor via eccentric transmission mechanism, to make the sliding grid do reciprocating movement, the relative position between sliding grid and fixed grid is changing continuously, pellet feed is discharged through the gap of these two grids. The relative position dimension between the grids is a and b. The working sketch of sliding grid see Figure 5, in which Ⅰ is non-discharging position, Ⅱ is discharging position. Cooling wind come in from the bottom of product discharging mechanism in all directions while cooling, and goes inside the cooling bin through the gap of sliding grid and fixed grid, flows through the product layer to conduct heat exchange.

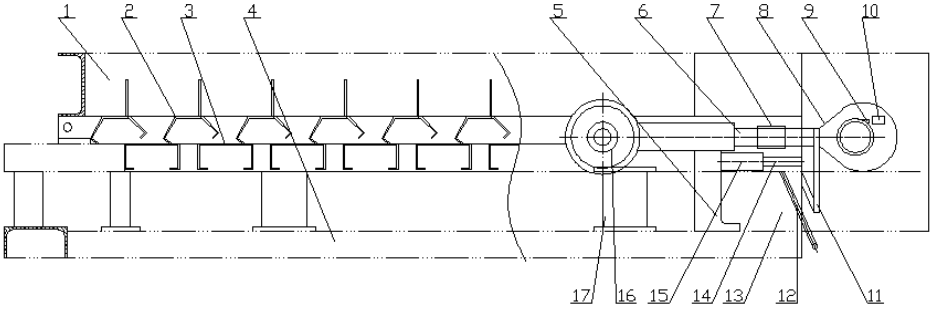


Figure 4 Slide valve product discharging mechanism

1. Spacing grid 2. Sliding grid 3. Fixed grid 4. Machine frame 5.Adjusting pad 6. Screw thread rod 7. Connection rod 8. Swing rod 9. Eccentric block 10. Limit switch 11. Hand wheel 12. Lock nut 13. Fixed grid adjusting base 14. Adjusting screw 15. Screw connection base 16. Roller wheel 17. Guiding rail

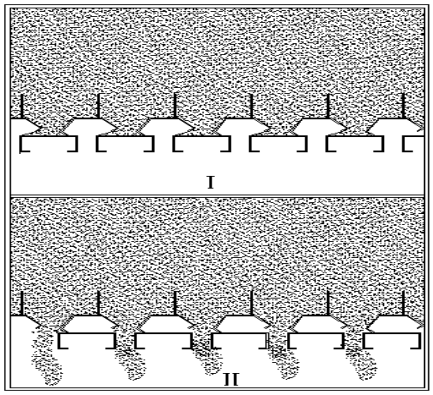


Figure 5 Working sketch of sliding grid

1. Spacing grid 2. Sliding grid 3. Fixed grid

Ⅰ. Non-discharging position Ⅱ. Discharging position

Cooler is discharging intermittently, i.e. the sliding grid is working non-continuously, when

the sliding stops it should at the Ⅰ position in Figure 5, so would not leaking product. In order to keep it at non-leaking position when the sliding grid is not working, only need the machine stop when the limit switch touches the limit block (only valid when the low level indicator gives stop discharging signal).

3. Fixed Grid Adjusting Mechanism

The fixed grid adjusting mechanism is specially used to adjust the relative position between fixed grid and sliding grid so that the sliding grid lies in utmost position when the machine stops intermittently to avoid feed leakage; meanwhile the discharging flow can be increased and reduced properly.

4. Cooling Bin

The cooling bin is used to store and cool the feed. It consists of airlock feeder, top cover, bin, high and low level indicators, sight glass and housing.

The high and low level indicators control the height of pellet feed in the cooling bin and are the control components which make the discharging motor work or stop. When feed layer reaches the high level indicator, the discharging motor starts to work; when feed layer is lower than the low level indicator, the discharging motor stops working. And the discharging motor starts to discharge the feed once again when feed layer reaches the high level indicator. Like that, production keeps repeating the process to make the discharging motor work intermittently. The adjustment of position of high and low level indicators can change the cooling time of feed in the bin. When level indicator is adjusted to higher position, the cooling time is long, conversely, short.

5. Machine Frame

The machine frame is connected with the hopper and supports the whole weight of machine. The hopper collects the discharged cool feed and discharges them from the outlet. The cool air is sucked in four directions from the gap on the top of hopper.

Ⅳ. AIR NETWORK SYSTEM

The air network system is the necessary equipment supplying the cool air. It consists of cyclone, airlock, fan and pipes. See Figure 6.

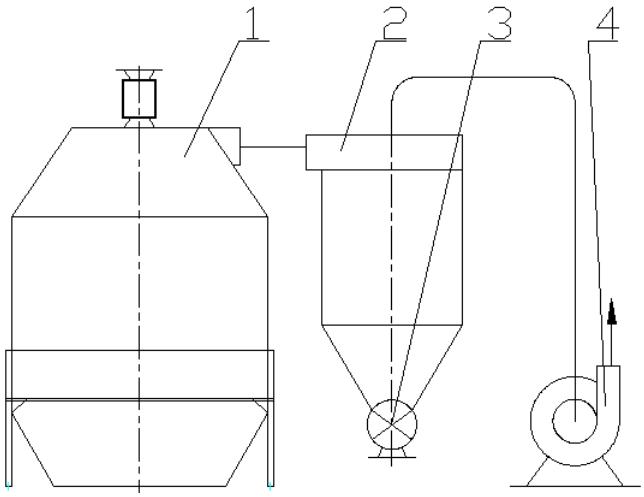


Figure 6 Cooling air network setup

1. Counterflow cooler 2. Cyclone 3. Airlock 4. Fan

Fan is located behind the cyclone and they are connected with air duct. Try the best to shorten the length of air duct, especially for the horizontal section, and to reduce the quantity of bend. The outer wall of duct should be covered with thermal insulation material to avoid condensation and prevent the powder feed forming therefore from blocking the air duct. An air volume adjusting device should be installed in the pipeline to adjust the air volume.

Select the fan according to the capacity of cooler. The calculation parameter of air volume is 25～34m^3 /t·min.

The air volume is related to the diameter of pellet to be cooled. Small diameter needs low air volume, conversely, high air volume. See Table 2.

Table 2 Aspiration Volume per Ton of Pellets with Different Diameters

Pellet diameter (mm)	≤5	≤6	≤10	≤20	≤22
Aspiration volume per ton of feed (m3/t.min)	22	25	28	31	34

Make calculation according to the aspiration volume needed by pellet with large diameter when determining the aspiration volume. Thus, you only need to adjust the air valve when pellet with small diameter is cooled.

The matched fan for each model of cooler, see Table 3

Table 3

Mode / Parameter	SKLN1.5	SKLN2.5	SKLN4	SKLN6	SKLN8
Aspiration volume m3/h	5040~ 7120	10080~ 12240	16800~ 20400	17463~ 22435	31200~ 39100
Air pressure mm water column	200	200	200	200	200
Fan model	4-72-11 No4A	4-72-11 No5A	4-72-11 No5A	4-72-11 No6C	4-72-11 No10C
Fan power kW	5.5	11	15	22	30

Ⅴ. ELECTRIC CONTROL

Electric control principle of counterflow cooler see Figure 7.

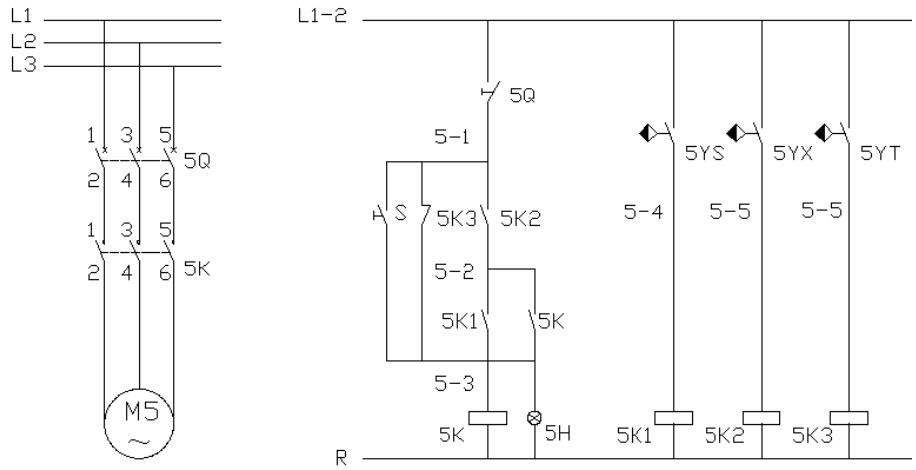


Figure 7 Electric diagram of counterflow cooler

Code	Name	Specification	Unit	Qty.
5Q	Automatic switch	N611 4A	pc	1
5K	AV contactor	BP 200V	pc	1
5K1, 5K2, 5K3	Solenoid relay	HH52P 200V	pc	3
$5Y_S$, $5Y_X$, $5Y_T$	Level indicator	TWL25	pc	3
5H	Indicator light	NDDH16-5	pc	1
S	Toggle switch	JK812-1	pc	1

The electric control of counterflow cooler mainly is to realize automatic product discharging and positioning of slide valve discharging mechanism by the sensing of product situation with proximity switch (i.e. level indicator), in which 5YS is high level indicator, 5YX is low level indicator, 5YT is positioning limit switch.

Close automatic switch 5Q, place the discharging button 5S open, with the increasing of pellet in cooler, the low level indicator 5YX sense and close, the solenoid relay $5K_2$ gain electricity, the normally open contact $5K_2$ pickup, gives necessary condition for automatic discharging, when the pellet goes up to certain height, the high level indicator 5YS sensor and close, solenoid relay $5K_1$ gain electricity, its normally open contact $5K_1$ close, contactor solenoid 5K gain electricity, its auxiliary contact 5K close and self-lock, main contact 5K connect, counterflow cooler start discharging, indicator light 5H is on, when the pellet is discharged lower than high level 5YS, relay solenoid 5K1 lose electricity, but because the self-lock of contactor 5K auxiliary contact, counterflow cooler continues discharging, when discharged lower than low level indicator, relay solenoid $5K_2$ lose electricity, its normally open contact $5K_2$ open, contactor solenoid 5K lose electricity, counterflow cooler stop discharging, and with the positioning control of positioning limit switch 5YT, the discharging mechanism is stopped at right place, indicator light 5H is off, and repeat the above process.

After the production finishes, in order to evacuate the pellet inside the cooler, could close the manual discharging switch 5S, then the counterflow cooler would work continuously until all the pellets are discharged, open 5S, all stop.

Ⅵ. INSTALLATION

1. This machine should be generally installed on the solid level foundation and tightened with anchor bolts. If the workshop ground is solid, foundation need not be constructed separately. The machine can be fixed on the workshop ground directly with expansion bolts or in other ways. Or should make the foundation per Figure 8, the anchoring bolt dimension and the reserved openings for material inlet and outlet is per Figure 9.

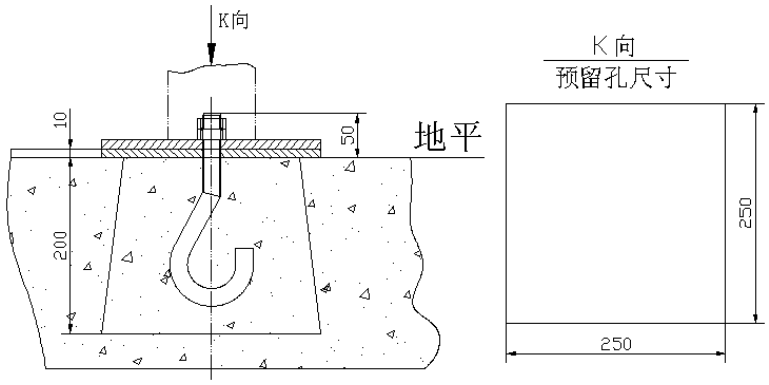


Figure 8 Embedded bolt foundation

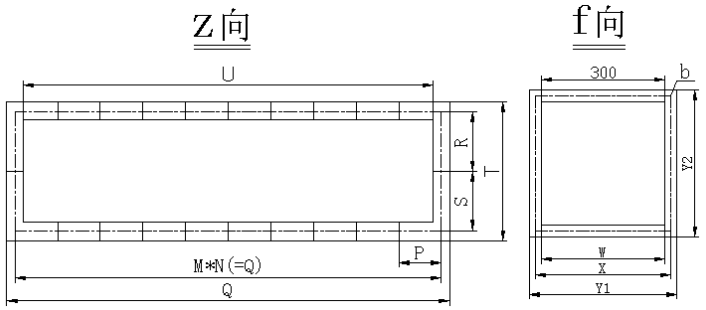
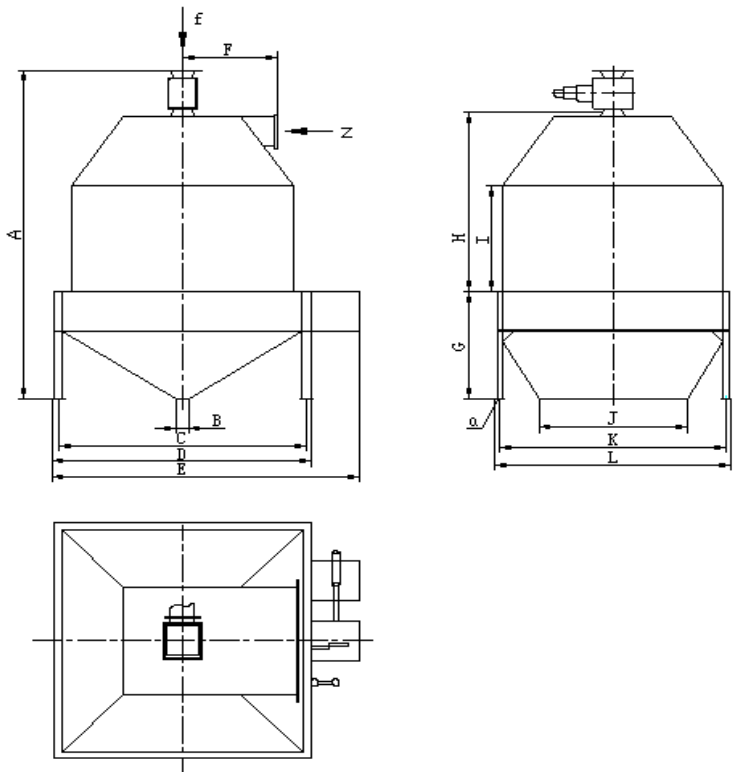


Figure 9　Sketch drawing of counterflow cooler



Item / Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N
SKLN1.5	2630	100	1480	1600	2010	600	910	1400	1100	1000	1270	1330	220	3
SKLN2.5	2800	110	1800	1920	2330	700	930	1540	1100	970	1600	1650	185	4
SKLN4	2560	110	2120	2240	2640	800	500	1600	1100	970	1909	2022	235	4
SKLN6	3690	110	2760	2880	3290	1000	1360	1880	1180	1650	2080	2130	258	5
SKLN8	3690	110	2760	2880	3290	1000	1360	1880	1180	1650	2560	2610	258	5

Item / Model	O	P	Q	R	S	T	U	V	W	X	Y1	Y2	a	B
SKLN1.5	660	220	700	100	100	240	620	160	160	190	220	220	4-φ14	4-φ12
SKLN2.5	740	185	780	120	120	280	700	200	220	250	280	280	4-φ14	4-φ12
SKLN4	940	235	980	145	145	330	900	250	275	305	450	450	4-φ14	4-φ12
SKLN6	1290	258	1330	170	170	380	1250	300	300	330	360	380	4-φ14	4-φ12
SKLN8	1290	258	1330	170	170	380	250	300	300	33 C	360	380	4-φ14	4-φ12

2. If placing the machine on the floor, weld the anchor bolts to the reinforcing bar in the floor, or make the bolts pass through the floor and clamp the foundation of this machine with a pressing plate.

3. Pay attention to the following points during installation:

① This machine is divided into several sections for packing and delivery. Assemble the machine according to Figure 1 and Figure 9 when installing.

② After the unpacking, carefully check to see if the cooler deforms or is damaged during the transportation, if fasteners become loose or come off, especially, if the connecting bolts of all parts become loose.

③ After the cooler is installed well, motor cable cannot touch or friction the machine frame or

other bodies. It would be better that cable is in a condition of natural hanging. The total length should be 3～5m, and the bent radius of the natural hanging part should be 0.5～0.7m.

④ When installing the cooler, try your best to align the position of feed inlet with the upper feeding port of airlock.

Ⅶ. ADJUSTMENT

1. Adjustment of Spreader

The spreader mounted in the top of cooler spreads the pellet feed coming inside the cooler bin to make the pellet feed basically accumulate in the bin evenly. If it is found that the feed in the bin is more in the center and less around, or less in the center and more around, that means the feed is not evenly spread. The distance between two rhomb taper spreaders on the top of machine needs to be adjusted.

Adjusting method: See Figure 3. Loosen the spreader-connecting bolts in the spreader housing on the top of bin firstly. At this moment, spreader can be moved towards two sides or center. Tighten the loosened bolts after adjusting.

2. Adjustment of High and Low Level Indicators

The position of the high level indicator determines the feed volume in the bin. The high level indicator should be generally put in a higher position to obtain more volume. Its best position is generally at the 3/4 height of bin sight glass.

The distance between high and low level indicators determines the discharging volume each time. The discharging volume one time is less for short distance, and more for long distance. When in use, the fixing plates of high and low level indicators are put together, the distance between high and low level indicators is about 60mm. Users can make adjustment according to needs. The adjusting range is generally 60～150mm.

When adjusting, users only need to loosen the screws in the fixing plates of level indicators, then the level indicators can be moved up and down. Finally tighten the screws.

3. Adjustment of Limit Switch

The purpose of this adjustment is to make the sliding grid be in the non-discharging position. See Figure 5. If the sliding grid is not in the required position when the machine stops, limit switch needs to be adjusted. The improved limit switch is mounted by the side of eccentric driving block and in the cover. When adjusting, users can adjust the angle of revolving arm of limit switch (unscrew the revolving arm fastening screw, adjust and re-fasten), or the position of limit switch so that limit switch touches the sliding grid and is in close state when the sliding grid moves to right limit position.

4. Adjustment of Position of Fixed Grid

The adjustment of fixed grid can change the relative position between it and the sliding grid and make the sliding grid be in limit position when the machine stops intermittently to avoid the feed leakage. At the same time, the flow volume of feed to be discharged can be properly reduced or increased. When adjusting, users only need to loosen the lock nuts in the adjusting screw rod, and turn the adjusting hand wheel clockwise or counter clockwise to make adjustable grid move forwards and backwards to the required position. Tighten all the lock nuts after adjusting.

Ⅷ. OPERATION

1. Before feeding formally, test-run the machine without load first, to see if all parts inside the machine are normal.
2. Check to see if bolts in the connecting sections of all parts are tight and reliable, if level indicators and limit switch are mounted in the best positions.
3. Check to see if there are impurities inside the machine and the sliding grid is flexible and reliable.
4. Feed firstly, and then start the fan to make the air aspiration system work normally until feed accumulates in the bin. When feed touches the high level indicator, motor runs and feed is discharged.
5. After the machine stops, feed in the machine should be completely discharged without any remainder to prevent pellets from sticking. The manual discharging method can be adopted to discharge the feed when the machine stops, that is, turn on the motor and then turn off the motor after all the feed in the machine is discharged. If feed variety need be changed or when the machine will be laid aside, feed in the machine must be discharged completely, especially the accumulated feed at the top. When discharging, users only need to start the manual switch of cylinder and make cylinder reciprocate for 3-5 times.

Ⅸ. TROUBLESHOOTING (See table 4)

Table 4

No.	Trouble	Cause	Troubleshooting
1	Cooling effect is poor	①Positions of high and low level indicators are not reasonable. ②Air valve is opened too small ③Air network system is not reasonable	①Readjust the positions of level indicators ②Adjust the air valve wider ③Setup the air network system reasonably
2	Feed is sufficient, but no feed is discharged	①Position of high level indicator is not reasonable ②High level indicator is damaged ③Circuit is in breakdown	①Readjust the position of high level indicator ②Replace the high level indicator ③Remove the circuit trouble
3	Discharging does not stop	①Position of low indicator is not reasonable ②There is dust on the surface of low level indicator ③Low level indicator is damaged ④ Circuit is in breakdown	①Readjust the position of low level indicator ②Clean the surface of low level indicator ③Replace the low level indicator ④Remove the circuit trouble
4	It is not closed tight with feed leakage when machine stops intermittently	Position of limit switch is not reasonable	Readjust the position of limit switch
5	Discharging volume is too less or too more	The relative position of fixed grid and sliding grid is not reasonable	Readjust the position of fixed grid

Ⅹ. REPAIR AND MAINTENANCE

1. Often clean and check the machine and make its surface keep clean.
2. Lubricate the bearing of combined airlock once a month.
3. Lubricate and clean the reducer once a year.
4. Lubricate the bearings of the roller wheel periodically.
5. When the machine will be laid aside, bin and hopper should be cleaned.

Ⅺ. TRANSPORTATION

Since SKLN counterflow cooler is quite high, 2 packages are used; the cooler is in two parts. Package I is machine body, package Ⅱ is material bin.

Ⅻ. EASILY-WORN PARTS

No.	Name	Qty.	Assemble position
1	Combined airlock	1	Top of bin
2	Roller wheel	4	Sliding grid
3	Guide rail	4	Machine frame

江苏中天农牧机械有限公司

JIANGSU ZHONGTIAN AGRO MACHINERY CO.,LTD

ADD: No.7 ZhongDaLi Road,New industrial Park,
DaiBu Town,LiYang,JiangSu,China.
P C： 213300
Tel： 13814760009
Fax:： 0086-519-87256670
Http://www.jsztmt.com
E-mail:info@jsztmt.com