ZWAHLEN & MAYR
ZM TUBES

Switzerland
4684681

1860 AIGLE – Route de l'Industrie 18 -
Tel.: +41 24 4684646 - Fax: +41 24
TVA N° CHE.108.107.754
E-mail : zmtubes@zwahlen.ch

TECHNICAL SPECIFICATION SIN-170423

Rif : OT/JM/DEC089 Date: 2023/6/23 1

From : Cristian Trevisan To: Mr Gong Jiawei

E-Mail : cristian.trevisan@zwahlen.ch Seller

XI'AN HEAVY EQUIP. & TECHNOL CO., LTD
3699 D Area Shanglin Road, Xi'an 710018 P.R China

DEFINITIONS:
Buyer, means Zwahlen & Mayr SA
Contract, means an order for goods and/or services to be provided by the Seller.
Seller, means the company as specified in the Purchase Order as Seller.
Parties, means any and all members of the combination of firms.

1	Technical Data
1.1	The scope of Supply is a complete equipment call LG-10-GHLL Cold Pilger Mill employed for the working of Hot and cold formed shells. As a result of the heavy simultaneous reduction in diameter and wall thickness eccentricities, the dimensional variations are reduced and the surface quality is improved. In cold Pilger mill the shell is forged and elongated over a stationary, tapered or conical mandrel by two lamination rolls which move back and forth over the shell. The rotation of rings are imparted by a mechanism composed of gears and racks. The Internal profile of tube is generated by a mandrel that rotates at every cycle with a defined angle. An essential aspect of the process lies in the fact that elongation of the shell is generated by simultaneous reduction of diameter and wall thickness. Following a forward and backward rolling cycle, the rolls release the shell which is then advanced by a certain feed value. As the shell is advanced, it is also put in rotation by a certain angle in order to achieve a perfect circular cross section. During cold Pilger process the huge plastic deformation of the shell generates a lot of heat. For this reason during Pilger process an important amount of lubricant is used both inside and outside shell. The ability of the lubricant to reduce wear decreases when temperature increases. Machine symbol description LG-D-GHLL
1.2	"LG" Cold tube mill Duo
1.3	"D" Normal diameter of finished tube
1.4	"G" High Speed
1.5	"H" Ring Die
	"LL" First L stands for long stroke, second "L" stands for continues working mode

2	Scope of Supply
	Mechanical components
2.1.1	Charging Table
2.1.2	Tube ID oil/grease lubrication device
2.1.3	Loading table
2.1.4	Feeding and turning worm gear box
2.1.5	1 and 2 feeding carriages,1# feeding bed & 2# feeding bed
2.1.6	Mill base frame
2.1.7	Mill saddle
2.1.8	Inlet and outlet Chuck
2.1.9	Crank drive box
2.1.10	Roll Assembly, quick change device
2.1.11	Finished tube pull out device
2.1.12	Unloading table included cutting device
2.1.13	Oils scrubbing device
2.1.14	Clamping and guiding tools
2.1.15	n. 10 different complete set of tools (only for engineering)
2.1.16	n.1 Set of spare parts
	Hydraulically System
2.2.1	Hydraulic power station (incl. Motor, pump, cooler, etc.)
2.2.2	Valves stand
	Lubrication system
2.3.1	Cooling and lubricating system (incl. Motors, pumps, cooler ,heater, indication instruments, etc.)
2.3.2	Suction belt filter
2.3.3	Inside tube lubrication unit
	Electrical System
2.4.1	AC Servomotor & Servo cables & drives
2.4.2	Main AC Motor & Drive
2.4.3	Other motor &Drive
2.4.4	Electrical cabinets
2.4.5	Split tube end detecting system
2.4.6	Main control desk (included HMI)
2.4.7	Push bottom panel
2.4.8	Others (included local bus system, I/O units, etc.)
2.4.9	Software of the control unit

ZWAHLEN & MAYR
ZM TUBES

Switzerland
4684681

1860 AIGLE – Route de l'Industrie 18 -
Tel.: +41 24 4684646 - Fax: +41 24
TVA N° CHE.108.107.754
E-mail : zmtubes@zwahlen.ch

TECHNICAL SPECIFICATION SIN-170423

3 Technical Parameters

3.1 General Data

3.1.1	Mill Model	LG-10-GHLL
3.1.2	Service	Cold rolling of tube shells
3.1.3	Material to be processed	Carbon steel, stainless steel, ally steel and non ferrous alloy metals such as zirconium, titanium, aluminum
3.1.4	Strength of material to be processed	max 1000 Mpa
3.1.5	Working mode	Continuous loading, feeding, and rolling without any stop

3.2 Entry Tubes

3.2.1	Outer diameter	12,0÷25,4	mm
3.2.2	Tolerance on OD	± 2%	mm
3.2.3	Wall thickness	1,2÷6	mm
3.2.4	Tolerance on wall thickness	±10%	mm
3.2.5	Length	2÷6	mm
3.2.6	Straightness	2	mm/m
3.2.7	Status of hollow tube	Annealed or solution treated, straighten and pickled	

3.3 Exit tubes

3.3.1	Outer diameter	6÷16	mm
3.3.2	Tolerance on OD	±0,3%	
3.3.3	Wall thickness	0,5÷4,0	mm
3.3.4	Tolerance on wall thickness	±3%	
3.3.5	Length max	24.5	m
3.3.6	Surface Roughness (Ra)	0,4÷0,8	µm

3.4 Mill Details

3.4.1	Ring die diameter	129÷135	mm
3.4.2	Ring die width	60	mm
3.4.3	Pinion and rack modules	3	
3.4.4	Stand stroke length	381	mm
3.4.5	dies working length	270	mm
3.4.6	Strokes per minute of working stand	300	stroke/min
3.4.7	Rolling force (max)	160	kN
3.4.8	Tube feed value per stroke	1÷5	mm
3.4.9	Angle of rotation per stroke	0÷90	°
3.4.10	Working line height (from floor)	850	mm
3.4.11	Feeding and turning mode	Twice turning and single feeding per stroke or twice turning and twice feeding	
3.4.12	Main motor power	75	kW

4 Description of Mill components

4.1 Charging area (charging table and tube ID lubrication device)

4.1.1	**The Charging Table** consists of material rest, kickoff mechanism, hollow blocked mechanism, height adjusted V type slot feed pinch roll unit, the kickoff mechanism driven by air cylinder will put the shell stored in the material rest to the V-slot. The feed pinch roll is driven by the speed-down motor, and feeds the blank in the V-slot to the mandrel rod, thorough the 1#mandel thrust block reaching to leading bed. All process is continues, and contact parts will be protected with polyamide, nylon or materials that will avoid any scratch or impact on shells.
4.1.2	**Tube ID Lubrication device**. The tube ID oil lubrication device is used to feed the lubricating grease into the shell. Because the OD of mandrel rod is too small to center the hole, this device could inject a low quantity of grease into the inner surface. The grease used for lubrication will be Lubra Absolute 1000XP having density higher that 1,2Kg/dm^3. Pneumatic grease pump or equivalent systems must be used to inject the mentioned typology of grease.
4.1.3	**Pinch Roll**. Rolls Support shell during charging. An pneumatic pinch roll driven by an electrical motor drives the shell into the guide of the clamp of the mandrel bar in the loading bed of the mill.
4.1.4	**Loading Bed** mainly consists of:
4.1.4.1	The two mandrel thrust blocks (MTB) with their rotary driven and hydraulically actuated clamping jaws serving to rotate the mandrel and keep it in the working position, the rotation movement is controlled via one servo motor per MTB (scope of supply of electric);
4.1.4.2	the 3 or 4 pinch roll units arranged between the two MTB (driven by one AC motor each);
4.1.4.3	The tube beds of welded construction upon which will be assembled the above described equipment's.
4.1.4.4	Rotation of mandrel will be the same of the shell. The mandrel rod is held in at least one or two MTB by hydraulically actuated clamping jaws. Both MTB are equipped with a rotary drive which is operated in a synchronous mode, related to the two alternative clamps.
4.1.4.5	When loading a new tube: During rolling a tube usually MTB1 will be operative. When loading a new tube MTB 2 is closed after the trailing end of the leading tube has passed. After closing MTB2, MTB1 will open and a new tube is fed through the open MTB1 into the loading area which corresponds to the maximum ingoing tube length. Transportation of new tube will be operated by several pinch rolls positioned one in front of MTB1 and the others in the loading bed between MTB1 and first clamping carriage. After the new tube arrives between the two MTB, i.e. on the loading bed, MTB1 is closed and MTB2 opened. The tube is fed through MTB2 until it reaches the end of the foregoing tube. The so-called follower pinch roll unit in front of the and behind MTB2 ensure the leading end of the new tube being always close to the trailing end of the leading one. The combination of two clamping carriages and two MTB described above allows the continuous operation of the Cold Pilger Mill without interruptions.

ZWAHLEN & MAYR
ZM TUBES

Switzerland
4684681

1860 AIGLE – Route de l'Industrie 18 -
Tel.: +41 24 4684646 - Fax: +41 24
TVA N° CHE.108.107.754
E-mail : zmtubes@zwahlen.ch

TECHNICAL SPECIFICATION SIN-170423

4.1.5	**Clamping and feeding carriages (1# & 2#, feeding bed, worm gear box)** mainly consists of:
4.1.5.1	Two complete clamping carriages for turning and advancing tube with hydraulically actuated adaptor sleeves
4.1.5.2	The worm gear box between the clamping carriages, consisting of:
4.1.5.2.1	Two individual turning servomotors, each with worm gear and spindle shafts as connection to the respective clamping carriage;
4.1.5.2.2	Two individual feeding servomotors, each with worm gear and screw shaft for connection to the respective clamping carriage;
4.1.5.2.3	The guides for the tubes in the gearbox area;
4.1.5.2.4	The beds for the clamping carriages in front and behind the gear box;
4.1.5.2.5	Shell junction detection sensor located in front of the 2# feeding bed.(supplied by buyer)
4.1.6	To reduce the size of the tube, at each stroke of mill saddle, shell has to be fed and turned with selected parameters.
4.1.7	Feeding of shell is performed by two clamping carriages positioned in front of the rolling area. One of the two clamping carriage clamps the tube by means of a hydraulically actuated sleeve. The carriage driven stepwise by a feed screw, moves in rolling direction and thus feeds the tube into the rolling area. Meanwhile, with open sleeve, the other clamping carriage moves back to its starting position. It takes over the feeding, after the first carriage has nearly reached its maximum travel distance. After closing the sleeve of carriage 2#, both carriages run in a synchronous mode shortly before carriage 1# opens the sleeve and moves back to its starting position.
4.1.8	Turning of tube is actuated by the synchronized rotation of sleeves that clamp the tube in each of the two carriages. Two main rotating chucks are positioned at the entry ant at the exit of the rolling area. All rotating sleeves will have synchronized movements.
4.1.9	All feeding and turning devices are driven by worm gear units and individual servomotors. Motor functions are controlled by the main drive of the mill. Servomotors allow to control and freely change the parameters of the mill.
4.1.10	Once the shell junction sensor detected the seam joint of two tubes, the software of machine will begin calculate the following parameters: times of mill saddle, forward amount, coefficient of elongation, position of deformation section with exact determination of transition of joint seam. This calculation helps the machine to control several steps, open/close of the outlet chuck, extract finished tubes with pinch roll, and mill speed automatically adapted.
4.1.11	**Rolling area (mill saddle, mill base frame & inlet and outlet chuck)** mainly consists of:
4.1.11.1	mill saddle;
4.1.11.2	One complete set of roll assemblies consisting of:
4.1.11.2.1	two ring die shafts from hardened and tempered steel for shrinking on the ring dies;
4.1.11.2.2	blocks and bearings;
4.1.11.2.3	one set of drive pinions.
4.1.12	the wedge adjustments for the upper ring die assembly;
4.1.13	the two racks, serving to transmit the turning movements to the roll shafts integrated in the side plates of the machine frame, with vertical adjustment;
4.1.14	the inlet chuck for the entry tube with hydraulically driven clamping cylinder;
4.1.15	the outlet chuck for the entry tube with hydraulically driven clamping cylinder;
4.1.16	two chucks are driven by servomotors,
4.1.17	Movable cover with lights above mill saddle which is driven by hydraulic cylinder;
4.1.18	Oil injection equipment at front and on back part of the mill house (LCL).
4.1.19	The mill saddle will be mounted in the mill base frame, connected with one end of the connection rod through the pinch roll. Reciprocation of the mill saddle is realized though connecting rod pulling when the main motor turns continuously. In the mill saddle, two gears mounted respectively on upper and lower roll shafts will be connected with the two racks installed on the machine frame. When mill saddle moves, upper and lower rings will rotate synchronously in reverse direction to allow the lamination of the shell.
4.1.20	The mill base frame will be a Box Type structure, used for installation of mill saddle on the parallel slide plates. There will be a oil ring injector at front at on back of the mill frame, which injects the lubrication oil on rolls surface and deformation area for cooling and lubricating. This device must be suitable to use oil Lubra XP 150. There will be also an injection of oil for slide plates useful to reduce energy consumption with increased life of guides.
4.1.21	During rolling process, the top cover of the mill base frame will be closed in order to avoid lubricating oil from splashing. Furthermore, it can also reduce noise and the sickness sense of the personnel. There is a peephole and lighting on the cover that will allow the observation of operation and rolling status. Top Cover is open and closed by hydraulic cylinder, adopt the dual-button in series operation. During opening and closing process of the top cap, acoustic optic alarm in the electrical system can guarantee security of the equipment during operation.
4.1.22	Inlet and outlet chucks are used to guarantee that shell, finished pipe and mandrel rotates synchronously. It is driven by two servomotors. The inlet chuck helps the shell to rotate meanwhile the outlet chuck allows the rotation of finished tube. During rolling process, both inlet and outlet chuck have guide function of shell and tube. Both outlet and inlet chucks are equipped with hydraulic cylinder which pressure can be adjusted manually.
4.1.23	Crankshaft drive device consists of AC motor, hydraulics disk type brake, single arm crankshaft and sector piece, one connecting rod, balance shaft and sector piece as well as small gear, transition gear and one pair of big gears that have some number of teeth. The motor for LG10 will have the crankshaft rotated through the engagements each other of the small gear (modulus M=12 number of teeth Z= 28), transition gear (modulus M=12, number of teeth Z=43) and big gear (Modulus M=12, number of teeth Z=82) placed on the crankshaft. The connection rods pull the working frame to to-and-fro movement. As the number of teeth of the big gear on the single arm crankshaft is the same as the gear which engages with the balance shaft, the balance shaft will move as well. One phase position difference is between the one big sector piece on the single arm crankshaft and the two small sector pieces of the balance shaft, which form the horizontal mass balance system. Along with the movement of these components jointly, the inertia forced causes due to the to-and-fro action of the frame shall be poised.
4.1.24	**Discharging area** (discharging device, pull out pinch roll & oil scrubbing device). Consists of roll table, kickoff mechanism driven by air cylinder and receiving carriage. The pull-out pinch roll will be used to extract tubes when rolling is carried out. This system is necessary in order to avoid collision between tubes (the one that is been laminated and the other that has just finished the lamination process). Both upper and lower rollers of device are driven together by one small type motor When it is necessary to extract the tube, the hydraulic cylinder will start working , and both the upper and lower extractor rolls will close to the tube and start rotating. Position of the pinch roll must be calculated in order to give the right timing for the following activity

ZWAHLEN & MAYR
ZM TUBES

Switzerland
4684681

1860 AIGLE – Route de l'Industrie 18 -
Tel.: +41 24 4684646 - Fax: +41 24
TVA N° CHE.108.107.754
E-mail : zmtubes@zwahlen.ch

TECHNICAL SPECIFICATION SIN-170423

4.1.25	**Cutting Table** composed of one pinch roll, one cutting shear, one stopper, rotating conveyor, pneumatic cylinders for tube unloading and tube receiving cradle. The maximum length of tubes before cut will be 24,5m. The maximum length of cut tubes will be 12m. The system will operate in the following mode. When tube is extracted with the pinch roll of position 4.1.24 there will be two possibilities: first one tube to be discharged without cut and second one tube to be discharged with cut.
4.1.25.1	**Tube without cut,** the extractor pinch roll will be activated and tube will arrive to shear pinch roll that will clamp the tube (while extractor pinch roll will be disactivated) and transport it till the stopper. Shear pinch roll will open and the tube will be deposed into the cradle with the intervention of pneumatic cylinders that will turn the outlet rotating conveyor. Rotation of outlet conveyor will be allowed because no other tubes are present in the outlet rotating conveyor. To reach that condition calculation of the right position of extractor pinch roll is required and also a sensor shall be put after the extract pinch roll. The dimensions and configuration of the conveyor must avoid any block, resistance, interference to the flowing of the tube.
4.1.25.2	**Tube with cutting,** the extract pinch roll will be activated and tube shall arrive to shear pinch roll that will clamp the tube (while extract pinch roll will be disactivated) and transport it till the stopper. When tube arrives to stopper the two shear clamps will close to tube and shear will start descending and running. Tube will be cut. After Cut is done the two shear clamps will open , shear will lift and side of tube cut will be deposit in cradle with the intervention of the outlet rotating conveyor. The remaining tube has two possibilities. To be deposed directly in cradle if no more cut is need or in case a new cut is required the shear pinch roll will be activated and tube will be drive till stopper for a new sequence of cut. All sequence of cutting will be controlled by tube sensor positioned on conveyor. If tube sensors detected an arrival of new tube in conveyor shall emit a light and a sound alarm 30 seconds before stop Pilger run.
4.2	Hydraulic System
4.2.1	The hydraulic system includes hydraulic station, corresponding solenoid electric valves and pipelines. Hydraulic system will be positioned at the driving sig of the rolling mill and used to drive the following oil and pneumatic cylinders:
4.2.1.1	Shell lubrication device (air cylinder used);
4.2.1.2	Clamping and unclamping oil cylinder of mandrel's bar
4.2.1.3	Outlet and inlet chuck oil cylinder;
4.2.1.4	Mill stand cover lifting and closing cylinder;
4.2.1.5	Cylinder of quick drawing mechanism of finished tube;(air cylinder used)
4.2.1.6	Cylinder of unloading device;(air cylinder used)
4.2.1.7	Brake cylinder of crank drive box.
4.2.2	Composition of hydraulic System:
4.2.2.1	Oil tank element: That is composed of oil tank, cooler, filter, oil return filter, air cleaner, heater, liquid level, temperature detector and signal sending display element and more to guarantee that system is working in normal conditions. The system will be able to store and supply clean oil to all devices in conformity with system operation requires.
4.2.2.2	Main pump device: composed of a constant pressure variable pump, motor group, pressure relay and more. It will be mainly used to supply constant power oil for hydraulic system;
4.2.2.3	Control valve set, it is composed of block valve, various directional valves, flow valves and more. This system is met to allow the system to control the movements off all cylinders during rolling process and adjustment process of the mill.
4.2.2.4	Hydraulic pipelines and pipeline fittings, included steel pipe, pipe joint, flanges, sealing elements, channel steel, plastic pipes clips and more with the following main data:
4.2.2.4.1	Working pressure: 10 Mpa
4.2.2.4.2	Working Medium N46 anti-wear hydraulic oil
4.2.2.4.3	Filtration accuracy of hydraulic oil = 20 μm
4.2.2.4.4	Working temperature of oil 33÷50°C
4.2.2.4.5	Cooling water pressure 0,2÷0,4 Mpa
4.2.2.4.6	Cooling water inlet temperature <= 32°C
4.2.2.4.7	Cooling water quality: Purified circular water
4.2.2.4.8	Consumption of circular water = 4 m^3/h
4.2.2.4.9	Volume of oil tank = 1 m^3
4.2.2.4.10	Rated flow = Q = 40L/min
4.2.2.4.11	Rated power of oil pump motor = 11kW
4.2.2.4.12	Floor space dimensions = 1600x1400 [mm]
4.2.3	Feature of hydraulic system: the constant pressure variable pump will be selected as main power supply which can guarantee that input pressure of system will be constant and also heating decrease and power loss during flow regulation process of system. Between main motor and pump a rubber seat is inserted in order to reduce the knock start inertia and running noise. Start and stop of motor pump can be realized under no-load condition. Accumulator is adopted to prevent hydraulic shock. An accumulator is adopted to avoid any hydraulic shock. The cushioning self-locking oil way of accumulator and overload protective system can guarantee reliable operation of the hydraulic cylinder to meet quick oil filling, pressure maintaining, cushion and other requirements of the system. The oil tank is provided with monitoring and alarm functions for oil temperature and liquid level.

ZWAHLEN & MAYR
ZM TUBES

Switzerland
4684681

1860 AIGLE – Route de l'Industrie 18 -
Tel.: +41 24 4684646 - Fax: +41 24
TVA N° CHE.108.107.754
E-mail : zmtubes@zwahlen.ch

TECHNICAL SPECIFICATION SIN-170423

4.2.4	Lubrication System
4.2.4.1	Includes oil tank, pump system, suction belt filter, heater, plate heat exchanger, pipeline auxiliaries and more. The lubrication system includes process cooling lubrication and mandrel systems.
4.2.4.2	Process lubrication system
4.2.4.3	System is used to cool and lubricate of shell roll collar and mill stand slide track, crankshaft bearings, middle bed body guide track and lead screw. The oil in the crankshaft driving box and mill stand flows into the dirty oil tank, then pump draw dirty oil to suction belt filter, then clean filtrated oil flows into the tank in the pit because of the dead weight function.
4.2.4.4	For cooling and lubrication of roll collar middle bed body guide track and lead screw:
4.2.4.4.1	Pump pressure: 1MPa
4.2.4.4.2	Pump quantity: 1 set
4.2.4.4.3	Pump form: Screw pump
4.2.4.4.4	working medium: rolling oil
4.2.4.4.5	Oil supply flow. 160 l/min
4.2.4.4.6	Filtration accuracy: 120μm
4.2.4.4.7	Power of motor: 5.5kW
4.2.4.5	For bearings of roll assembly:
4.2.4.5.1	Pump pressure: 1,5MPa
4.2.4.5.2	Pump quantity: 1 set
4.2.4.5.3	Pump form: screw pump:
4.2.4.5.4	Working medium Rolling Oil
4.2.4.5.5	Oil Supply flow: 63 l/min
4.2.4.5.6	Filtration accuracy of screen oil filter (following filter after suction filter belt): 80 μm
4.2.4.5.7	Power of motor = 3 kW
4.2.4.6	For bearings and crank drive box
4.2.4.6.1	Pump Pressure: 1,5 Mpa
4.2.4.6.2	Pump qty: 1 set
4.2.4.6.3	Pump form: Screw Pump
4.2.4.6.4	Working medium: rolling oil
4.2.4.6.5	Oil supply flow: 100 l/min
4.2.4.6.6	Filtration accuracy of screen oil filter (following filter after suction filter belt): 80 μm
4.2.4.6.7	Power of motor: 5,5 kW
4.2.4.7	For mill stand slide track & drive gears with racks
4.2.4.7.1	Pump Pressure: 1 Mpa
4.2.4.7.2	Pump qty: 1 set
4.2.4.7.3	Pump form: Screw Pump
4.2.4.7.4	Working medium: rolling oil
4.2.4.7.5	Oil supply flow: 40 l/min
4.2.4.7.6	Filtration accuracy : 120 μm
4.2.4.7.7	Power of motor: 1,5 kW
4.2.4.8	lubricating oil circulation filtration
4.2.4.8.1	Pump Pressure: 0.5 Mpa
4.2.4.8.2	Pump qty: 1 set
4.2.4.8.3	Pump form: Screw Pump
4.2.4.8.4	Working medium: rolling oil
4.2.4.8.5	Oil supply flow: 400 l/min
4.2.4.8.6	Power of motor: 7,5 kW
4.2.4.9	lubricating oil circulation coolling
4.2.4.9.1	Pump Pressure: 0.5 Mpa
4.2.4.9.2	Pump qty: 1 set
4.2.4.9.3	Pump form: Screw Pump
4.2.4.9.4	Working medium: rolling oil
4.2.4.9.5	Oil supply flow: 160 l/min
4.2.4.9.6	Power of motor: 3kW
4.2.4.10	Technical parameters of the suction belt filter
4.2.4.10.1	Filter medium: non woven fabrics
4.2.4.10.2	Fan motor: 7.5kW
4.2.4.10.3	Motor for moving filter medium: 0,55 kW
4.2.4.10.4	Filtration accuracy: 120μm
4.2.4.11	Mandrel Lubrication System The tube ID oil lubrication device is used to the lubricating grease into the shell .Main technical parameters are:
4.2.4.11.1	Working medium= Lubra XP100 grease
4.2.4.11.2	Pump form: = Pneumatic diaphragm pump
4.2.4.11.3	Rated flow: 1.5kg/min
4.2.4.11.4	Pressure of air supply: 0.6-0.7MPa

ZWAHLEN & MAYR
ZM TUBES

Switzerland
4684681

1860 AIGLE – Route de l'Industrie 18 -
Tel.: +41 24 4684646 - Fax: +41 24
TVA N° CHE.108.107.754
E-mail : zmtubes@zwahlen.ch

TECHNICAL SPECIFICATION SIN-170423

4.3	Electronic System
4.3.1	The electrical control system of the mill has the main scope to control the speed of the main body, feed and turning controls, automation of mill unit, HMI, tube cutting device, and much more. In order to embody the overall requirement of advancement, application, safety and reliability, the system configuration level of the equipment is composed as follows:
4.3.1.1	Main transmission of the mill adopts AC drive systems. The feeding-turning units adopt 3-fully digital AC frequency conversion driving system. The main driving device adopts Siemens series products and adopts profinet for communication with CPU. Servo Control units adopted Bosch Rexroth full-digital servo system.
4.3.1.2	PLC control system adopts contact series controller of Bosch Rexroth Corporation with long distance I/O control Scheme. The control system, allocates the long distance distributing I/O module into various control cabinets and operating floor of the system.
4.3.1.3	Install HMI interference on the operating floor of the pipe mill. Communication with PLC is realized through ethernet network.
4.3.1.4	An integrated automatic network is formed by PLC, driving device and HMI interface.
4.3.1.5	The computer system has unique adjustment parameters pre-display function rolling condition, monitor and comprehensive alarm function of fault. During rolling process, speed, current and other main parameters are displayed on the screen. The operating personnel can consult the operation instruction maintenance remark, notice and other related content of the mechanical, electrical and hydraulic equipment at any moment.
4.3.1.6	Adopt the Schneider products made in China for low voltage electric components.
4.3.1.7	Proximity switch adopt the products by German brand.
4.3.1.8	L2 communication interface of the upper computer is reserved on the rolling mill
4.3.2	Driving Control System
4.3.2.1	The main rolling drive adopts a AC motor for driving. Two AC servo motors are adopted for feeding. Six AC servo Motors are adopted for revolution. Those servo motors are controlled by the high resolution coder to realize the synchronization of movements. Driving device for main driving motor adopts Siemens series products. Feedback and speed adjustment accuracy of the coder can reach to 0,1%, which can fully met the rolling expectations. Main features of the system are:
4.3.2.1.2	Communication with PLC programmable controller through configuration of a communication plate. A large quantity of data such : working order of device, fault diagnosis, information of fault and other data can be exchanged through network and PLC, and displayed on the HIM interface.
4.3.2.1.3	Abundant fault diagnosis functions, decades of fault diagnosis and alarm functions are set in the system. Any constant fault can be accurately judged, such as; Stall out measurement, power supply open-phase and more to greatly decrease the maintenance work quantity of the system.
4.3.3	PLC control system
4.3.3.1	Automatic system of the cold Pilger mill adopts a set of PLC device. The PLC control system adopts long distance I/O control scheme. Signals among PLC, driving device and HMI interface are transferred through network communication (profinet network). The whole control system composes an integrated automatic network. The system as the following advantages:
4.3.3.1.1	The communication mode replaces the point-to-point multi-line connection transmission mode, which basically solve the fault caused by connection, improve the reliability of the system and also reduce the maintenance workload.
4.3.3.1.2	Avoid large scale wiring, which not only reduce the cable cost, but also guarantee high flexibility of the system, adjustment and function expansion.
4.3.3.1.3	Adopt long distance I/O control mode with dispersed layout, so that each long distance I/O control unit has definite control range to simplify the field
4.3.4	Main function of PLC
4.3.4.1	Unit sequence and technical interlock control: take charge of the technical automation operation of whole unit, including start and stop control of various systems, interlock among various systems and selection of working systems and more.
4.3.4.2	Equipment detection and control of electromagnetic valve adopt long distance I/O module control, PLC shall perform relevant treatment in case of accident.
4.3.4.3	Master control and status display: receives and treat the operation control command from operating floor through the long distance I/O module configurated in the operating floor and transfer these commands to the PLC. The PLC performs master control on the control system in accordance with the operation command and related interlock condition. It receives mill working parameters from the data network to display them intensively in frame form on the HMI interface screen to supersede the analogue meter on the operating floor.
4.3.4.4	Fault detection and classification alarm: The PLC collects the working order data of transmission system etc. through the network in real time to judge whether various parts of the system are under normal operating conditions or not. While the system fault is detected, PLC performs related protection and alarm prompting in accordance with detected fault and the current working order of mill.
4.3.4.5	Basic and automatic network communication with long distance I/O transmission system, HMI operation interface through configuring related communication module.

ZWAHLEN & MAYR
ZM TUBES

Switzerland
4684681

1860 AIGLE – Route de l'Industrie 18 -
Tel.: +41 24 4684646 - Fax: +41 24
TVA N° CHE.108.107.754
E-mail : zmtubes@zwahlen.ch

TECHNICAL SPECIFICATION SIN-170423

4.3.5	HMI System			
4.3.5.1	The system is equipped with a HMI monitor operating station which is put on the main operating station. Ethernet network communication is adopted with PLC. The monitoring operating station is used to perform monitoring operation on the pipe mill unit. The interface includes:			
4.3.5.1.1	Production process			
4.3.5.1.2	Working order			
4.3.5.1.3	Parameter display			
4.3.5.1.4	The fault diagnosis mainly includes: Oil flow and oil temperature alarm in the transmission system, electrical system, lubrication system, liquid level, oil temperature pressure, oil cleaner pollution, alarm in hydraulic system, control of unloading and cutting table			
4.3.5.2	Main Monitoring Frame of HMI			
4.3.5.3	**N.**	**Frame category**	**Frame Number**	**Frame function**
	1	Unit process flow frame	1	Unit flow and parameter
	2	Operation preparation frame		Preparation condition, inspection before operation of equipment
	2.1	Electrical condition	1	
	2.2	Mechanical condition	1	
	2.3	Hydraulic condition	1	
	3	Display of unit parameter	1	Setting of unit operation par.
	4	Monitoring of transm. System	1	Condition and parameter of driving device
	5	Failure category alarm frame	1	Fault Inquiry
4.3.5.4	AC Servo-control System			
4.3.5.4.1	Adopt 8 AC servo motors in the revolution feeding system to realize stepless adjustment of pipe blank feeding quantity and adjustment of revolution angle. AC servo motor and all control elements of AC servo system adopt Bosch Rexroth products.			
4.3.5.5	Composition of electrical equipment			
4.3.5.5.1	Switch cabinet			
4.3.5.5.2	Speed adjustment cabinet (including incoming line reactor and autotransformer)			
4.3.5.5.3	Relay control cabinet (Including PLC and remote I/O)			
4.3.5.5.4	1 cabinet of servo Driver (including Servo Driver)			
4.3.5.5.5	Main operating desk (Including PLC and remote I/O)			
4.3.5.5.6	Assistant operating desk (including PLC and remote I/O)			
4.3.5.5.7	Detector switch			
4.3.5.6	Main parameter of electrical control System power supply			
4.3.5.6.1	Primary circuit: Voltage class = AC400V			
4.3.5.6.2	10% number of phases: three-phase five-wire			
4.3.5.6.3	Frequency 50Hz (frequency fluctuation -1,+0,5Hz)			
4.3.5.7	Electrical control equipment and software			
4.3.5.7.1	N.	Description	Qty	Remark
	1	Switch cabinet	1 set	China Nat. Heavy machinery research Institute Co
	2	AC drive cabinet of main motor	1 set	Siemens with communication board, operating panel and communication cable
	3	Servo driving cabinet	1 set	China Nat. Heavy machinery research Institute Co
	4	Relaying cabinet	1 set	China Nat. Heavy machinery research Institute Co
	5	Operating floor	1 set	China Nat. Heavy machinery research Institute Co
	6	Operating box	1 set	China Nat. Heavy machinery research Institute Co
	7	Incoming line reactor and autotransformer	1 set	Domestic product
	8	PLC/CPU	1 set	Rexroth Bosch
	9	Dispersed I/O station	several	Rexroth Bosch
	10	AC power supply	several	Siemens

ZWAHLEN & MAYR
ZM TUBES

Switzerland
4684681

1860 AIGLE – Route de l'Industrie 18 -
Tel.: +41 24 4684646 - Fax: +41 24
TVA N° CHE.108.107.754
E-mail : zmtubes@zwahlen.ch

TECHNICAL SPECIFICATION SIN-170423

5.0 Main tools

5.1 The following main tools will be engineered and all detailed drawings will be send to customer. The detail engineering shall include mandrel bar, any typology of clamps for shell rotating, all typology of supports and bushes used to drive shell and tube, pinions, specific mandrel（basic Overall dimensions design）, lamination roll（basic Overall dimensions design）,clamps for cutting device and in general all components and accessories required to allow machine produce the specific product.). All drawings shall be as shop drawings.

5.2

Pos.	Mother Shell		Finished Tube	
	OD	WT	OD	WT
	toll.	toll	toll.	toll.
	+/-0.1mm	.+/-10%	+/-0.05mm	+/-2,5%
1	25.4	2.77	14	1.5
2	25.4	2.77	12.7	1.25
3	25.4	2.11	12	1
4	19.05	2.11	10	1
5	19.05	2.11	9.53	0.89
6	19.05	2.77	9	1.5
7	16	2.11	8	1
8	16	2	6.35	0.89
9	16	2	6	1
10	12	1	5	0.5
	Tools for testing(No.3,4,6,8 ,not including roll dies and mandrels) will be supplied with machine.			

5.3 The total quantity of tools supplied (green color)must be enough to conduct tests and to sign the Certificate of Approval. Minimum quantity of spare parts must to be taken into account.

5.4 Lamination rolls and mandrels must be distinguishable by marking on each piece with significant data (EA final diameter and wall thickness).

5.5 The following components will be included in the supply:

n	Description	Qty
1	Roll Assembly (excluding roll dies)	4
2	Mandrel (excluding mandrels)	6
3	Bushes of the rolling line per process route	4
4	Claws of the mandrel thrust block (4 groups)	12
5	Claws of the feed carriage (4 groups)	12
6	Claws of the inlet chuck (8 groups)	24
7	Claws of the outlet chuck (8 groups)	24
8	Pinch Roll Roller	20
9	Feed nut of feed carriage	2
10	Feed screw shaft	2
11	Turn Spline Shaft	2
12	Wear plates of mill base frame	1
13	Wear plates of feed carriage	2
14	Wear plates of feed bed	4
15	Wear plates of the mill saddle	1
16	Hollow shaft entry chuck	1
17	Hollow shaft for exit chuck	1
18	Hollow shaft for mandrel trust chuck	1
19	Racks	2
20	Jaws per Cutting saw	20

5.6 Seller is not liable for poor engineering of equipment, in particular rolls and mandrels. If commissioning and subsequent productions are compromised due to poor engineering, the supplier must submit new drawings and recognize the costs caused.

5.7 Buyer will produce mill rolls and mandrels required for commissioning tests.

5.8 Mandrel Breakage detecting system and Tube joint detecting systems will be provided by Buyer. Seller is responsible for installation and proper functioning.

5.9 Buyer will supply anchor bolts, washers, nuts, flat shims and slanted shims for installation.

5.10 Buyer will supply Pipeline materials and pipeline accessories between hydraulic station to equipment and lubrication station to equipment.

5.11 Cable power connection will be installed by buyer.

5.12 Shells and control instruments will be under buyer's responsibility.

5.13 Hydraulic, lubrication oil and grease are under Buyer's responsibility.

ZWAHLEN & MAYR
ZM TUBES

Switzerland
4684681

1860 AIGLE – Route de l'Industrie 18 -
Tel.: +41 24 4684646 - Fax: +41 24
TVA N° CHE.108.107.754
E-mail : zmtubes@zwahlen.ch

TECHNICAL SPECIFICATION SIN-170423

6.0 Spare part List

	N	Part	Name, part Unit, Number per
6.1	1.	09501.2.5-5	Guide sleeve Piece 1 PIECE
6.2	2.	09501.2-1	Bell mouth Piece 1 PIECE
6.3	3.	09501.3-6	Slide plate（I） Piece 8 PIECES
6.4	4.	09501.3-23	slide plate（II） Piece 2 PIECES
6.5	5.	09501.3-24	slide plate（III） Piece 2 PIECES
6.6	6.	09501.3-18	Lining board Piece 1 PIECES
6.7	7.	09501.4-16	Slide plate(I) Piece 4 PIECES
6.8	8.	09501.4-19	Slide plate(II) Piece 2 PIECES
6.9	9.	09501.3.4-3	Slide bushing of claw Piece 2 PIECES
6.10	10.	09501.3.4-5	Inlet claw Group 3 GROUPS
6.11	11.	09501.3.8-2	Outlet claw Group 3 GROUPS
6.12	12.	09501.3.4-4	Seat of claw Piece 6 PIECES
6.13	13.	09501.3.4-14	Guide sleeve Group 2 GROUPS
6.14	14.	09501.6.1-1	Upper slide plate（I） Piece 4 PIECES
6.15	15.	09501.6.1-12	Introduction sleeve Group 2 GROUPS
6.16	16.	09501.6.1-2	Side slide plate（I） Piece 4 PIECES
6.17	17.	09501.6.1-29	12-10 Type Claw Group 1GROUPS
6.18	18.	09501.6.1-30	20-24.5 Type Claw Group 1 GROUPS
6.19	19.	09501.6.1-3	Upper slide plate（II） Piece 4 PIECES
6.20	20.	09501.6.1-4	Side slide plate（II） Piece 4 PIECES
6.21	21.	09501.6.1-45	Balancing spring（I） Piece 10 PIECES
6.22	22.	09501.6.1-46	Balancing spring（II） Piece 10 PIECES
6.23	23.	09501.6.1-48	Rubber spring Piece 12 PIECES
6.24	24.	09501.6.4-3	Guide sleeve Piece 2 PIECES
6.25	25.	09501.6-13	Guide sleeve（II） Piece 2 PIECES
6.26	26.	09501.6-8	Guide sleeve（I） Piece 2 PIECES
6.27	27.	09501.7-15	Troughing cover（II） Piece 2 PIECES
6.28	28.	09501.7-16	Plastic bushing Piece 2 PIECES
6.29	29.	09501.9.1-23	Guide sleeve Group 2 GROUPS
6.30	30.	09501.9.1-7	Sliding bush Piece 2 PIECES
6.31	31.	09501.9.1-8	Claw Set 2 SETS
6.32	32.	09501.9.2-3	Roller Piece 20 PIECES
6.33	33.	09501.9.4-2	Drop guide tube Group 3 GROUPS
6.34	34.	09501.9.4-3	Guide sleeve Group 3 GROUPS
6.35	35.	09501.9.6-5	Guide sleeve Group 6 GROUPS
6.36	36.	09501.4.3	Assembly of mill roll Set 1 SET
6.37	37.	09501.6-21	Slide Plate Piece 4 PIECES

The left List is for reference only, spare parts will be supplied according to 5.5 table by supplier .Final drawings List of the parts only can be determined after Detail design.

7 ACCEPTANCE CERTIFICATE

7.1 The production Target of the mill will be demonstrated at average productivity rate indicated in below table 7.1.1 for selected tools.

7.1.1

DIAM IN	WT	WEIGHT IN	SEC. IN	DIAM OUT	WT OUT	WEIGHT OUT	SEC. OUT	ELONGATION	SPEED	REDUCTION	FEED	Efficency	PRODUCTIVITY m/h	
[mm]	[mm]	[kg]	[mm^3]	[mm]	[mm]	[kg]	[mm^3]	[mm]	[r/min]	[%]	[mm]		100%	With efficency
25,4	2,11	1,23	80,7	12,00	1,00	0,275	18,1	4,467	280	77,6%	2	0,92	150	138
19,05	2,11	0,89	59,6	10,00	1,00	0,225	14,9	3,971	280	75,0%	2,2	0,92	147	135
19,05	2,77	1,13	76,9	9,00	1,50	0,28125	19,4	4,008	280	74,7%	2,2	0,92	148	136
16	2	0,70	47,1	6,35	0,89	0,121485	8,3	5,762	280	82,5%	1,9	0,92	184	169

7.1.2	For each single test the duration will be 8 hours.
7.1.2.1	Average productivity rate per hour during the period of test must overcome the values indicated on column "productivity with efficiency".
7.1.2.2	Product quality of finished tubes must be acceptable following European (EN 10216-5) and American Standard (ASTM A213).
7.1.2.2.1	Outside diameter of finished tube = Nominal (± 0,05mm)
7.1.2.2.2	Wall thickness = Nominal (± 10%)
7.1.2.2.3	Roughness =1/3 of Shell
7.1.3	Seller as the right to repeat three times the test within 1 month from first trial.
7.1.4	In case Seller is not capable to overcome test for his own responsibility, the buyer has the right to claim the Compensation according to term "7.3 Compensation due to non-achievement of the target performance figures" in business contract.

ZWAHLEN & MAYR
ZM TUBES

Switzerland
4684681

1860 AIGLE – Route de l'Industrie 18 -
Tel.: +41 24 4684646 - Fax: +41 24
TVA N° CHE.108.107.754
E-mail : zmtubes@zwahlen.ch

TECHNICAL SPECIFICATION SIN-170423

8	DOCUMENTATION
8.1	Manuals will be provided for Buyer's use and will cover the equipment included in the scope of supply. The Manuals will written in three languages that are French/Italian/English. The Seller's documentation numbering system and plant coding shall be conceived in order to have a clear relation between each Plant Unit and its documents. Metric units will be generally used, exceptions could be made for piping and auxiliary equipment. Drawing documentation and manuals will be supplied on electronic files and will be readable and printable in standard formats (.tif) /(Word) /PDF.
8.2	A complete set of DWGS and documents will be issued by Seller for general Layout, take over points, foundations, power requirements, hydraulic, air and fluid connections. Moreover all prescriptions for lifting handling and all need to prepare the mill area by the buyer must be included in this package of documents.
8.3	A complete Operational and Maintenance Manual will be issued by Seller with delivery of the mill.
8.3.1	The Manual must contain detailed information concerning the following aspects:
8.3.1.1	Mechanical on Board systems, Main data on IN and OUT products;
8.3.1.2	Main process parameters;
8.3.1.3	Product calculation;
8.3.1.4	Power calculation of the production line;
8.3.1.5	Specific description of each machine and part of the plant function;
8.3.1.6	List of running spare parts and consumables, Shop drawings or commercial references for each single wear part;
8.3.1.7	Schematic assembly DWGS;
8.3.1.8	Machine functional Diagrams;
8.3.1.9	Maintenance DWGS;
8.3.1.10	On board Piping and supports;
8.3.1.11	Hydraulic circuit diagram;
8.3.1.12	Lubrication circuit diagram; Bill of material complete for Hydraulic and lubrication components;
8.3.1.13	Main electrical and automation equipment, the item refers to all technological parts (electrical motors, automation panels, main control desks, drives and MCC switchboards) and the related electrical systems and cables;
8.3.1.14	Motors and sensor list;
8.3.1.15	Automation block diagrams;
8.3.1.16	Ethernet and fieldbus network diagrams;
8.3.1.17	Technical specification for switchboards and panels;
8.3.1.18	Layouts and internal connections;
8.3.1.19	I/O list for automation panes;
8.3.1.20	Typical wiring diagrams;
8.3.1.21	System basic software with documentation;
8.3.1.22	Electrical drawings for main equipment including layout of commands, functional diagrams, component list component arrangement and terminal strips;
8.3.1.23	Piping and instrumentation diagrams that provides a schematic representation of piping, process control and instrumentation. Schematic and mechanical drawings will show all equipment connect, the pipelines and information concerning materials and sizes.
8.3.1.24	Diagrams must show all instruments, valves, accessories with their tag and indications;
8.3.1.25	Complete Bill of Material list for each hydraulic and lubrication system;
8.3.1.26	Pneumatic air diagram with sizes, connections, pipelines, schemas;
8.3.1.27	Cooling water system, connections, and requirements;
8.3.1.28	Operator manual including description of work areas (shop floor stations and main control desks) and description of operator workstation video pages, data entry and commands;
8.3.1.29	Instructions for unpacking, lifting and installation;
8.3.1.30	Preventive and extraordinary maintenance.
8.4	CE Marking with full comply to Directive 2006/42/EC that includes:
8.4.1	EC declaration of conformity of the machinery
8.4.2	CE Nameplate
8.4.3	Operating manuals including list of residual risks and Analysis Risk, in detail this analysis will be done with respect of requirements of EN 12100 and with other existing pertinent harmonized standards..
8.5	All DWGS & documents are supplied in PDF format, only general Layout & Civil basic engineering DWGS in dwg format.

9	Packaging and Transport
9.1	The plant after inspection by the purchaser or in any case after authorization for shipment must be appropriately packaged. Each individual component must be placed in suitable wooden crates, suitable packaging and sealed to prevent impact, oxidation. Special attention must be paid to sea salt prevention.
9.2	Incoterm is FOB CHINA port. That means costs for shipping between workshop and port, included loading and stowing are at Seller's charge. The FOB completion time is nine months after the contract is signed and becomes effective.
9.3	Any related taxes in China related to the execution of the project are at Seller's charge.

ZWAHLEN & MAYR
ZM TUBES

Switzerland
4684681

1860 AIGLE – Route de l'Industrie 18 -
Tel.: +41 24 4684646 - Fax: +41 24
TVA N° CHE.108.107.754
E-mail : zmtubes@zwahlen.ch

TECHNICAL SPECIFICATION SIN-170423

10	Advisory Services (On Site Services)
10.1	The Seller must send three (3) skilled technicians for technical assistance, assembling, commissioning and testing of machine). Seller specialist's shall cover all functions and aspects of mill included mechanical, hydraulics, electrical and electronic sections. Shall assist, participate and coordinate all activities need to fully comply with erection and commissioning aspects.
10.2	Seller declares that it complies, with respect to its employees, with all laws, regulations and agreements concerning economic and regulatory treatment, social insurance, protection and assistance against accidents at work and occupational diseases.
10.3	The Seller also declares that it is in good standing with regard to the payment of salaries, contributions, insurance, social security and welfare amounts, in accordance with the regulations applicable from time to time, and that it complies with and applies the regulations on the protection, insurance, social security and assistance of its employees.
10.4	Only personnel notified by the Contractor and authorized in advance shall be granted access to the complex where the services are performed.
10.5	The Seller shall ensure that its personnel do not for any reason enter areas that are not strictly related to the planned activities and that the working hours in force at the Customer's plant are observed.
10.6	The Seller undertakes to execute the entrusted works with scrupulous and constant observance of the legal regulations for the prevention of accidents and occupational diseases, for work hygiene and for the protection of the environment.
10.7	The Seller shall ensure that each employee and/or collaborator scrupulously observes the rules for the prevention of accidents and occupational illnesses, including the rules prescribing the use of personal protective equipment (PPE).
10.8	Costs for International air Tickets, flight fees belongs to supplier responsibility, lodging, domestic transport from hotel to buyer facilities belongs to Buyer responsibility. Level of accommodation will be adequate to buyer standards.
10.9	The Seller specialist's will participate, organize ad assist to commissioning tests in order to get the Final Acceptance Certificate.
10.10	Duration of assistance on site fully included in the package is 60 days (40 for installation and 20 for commissioning).
10.11	Any extension of the presence of the Seller's personnel at the site due to reasons for which the Seller is solely responsible will not be supported by the buyer.

11	On Site Training
11.1	The main target of theoretical training program is to instruct and share with buyer's staff knowledge regarding the operation, basic metallurgical process and maintenance of the supplied equipment. During erection and commissioning period the Seller's specialists will train buyer's staff in order to execute the following activities:
11.1.1	Operation; Includes (start up, operations, faults, emergencies, controls of process);
11.1.2	Mechanical Maintenance (includes inspections of critical parts, procedures care and conditions of fluids);
11.1.3	Automation (includes familiarization with pulpits an work stations, approach to PLC and HMI system, checking and tuning drive loops),
11.1.4	Electrical Maintenance (includes basic checks and inspections of critical parts, care and conditions of electrical systems, connection and location of circuits and devices);

BUYER		SELLER	
DATE	18.07.2023	DATE	
PLACE	Bigis	PLACE	
SIGNATURE		SIGNATURE	
POSITION	CEO	POSITION	
STAMP	Zwahlen & Mayr SA 1860 Aigle Tél. 024 468 46 46 Fax 024 468 46 00	STAMP	