

2.2.2.Compatibility drawing of face shield at height of 48 in.

Chinese Designed and Manufactured Longwall Roof Supports Operating at Oak Grove Mine

09:00 6/13/2017

Panel Discussion: First Chinese Shields operating successfully in a US Mine



ZMJ




2017 LONGWALL USA
Exhibition & Conference
June 13-15, 2017 - David L. Lawrence Convention Center, Pittsburgh, PA USA

Agenda

- 1. Introduction of Participants**
- 2. Process of buying *Chinese Shields***
- 3. Specific Design for Oak Grove**
- 4. Prototype Testing & Acceptance**
- 5. Mass Production**
- 6. Transportation Logistics**
- 7. Longwall Update**
- 8. Questions**

Participants

United Mining Equipment

Donald R. Simms – President/CEO
President – ZMJ America

Zhengzhou Coal Mining Machinery (Group) Co., LTD.

Youjin Gao – VP International Sales / Engineer
Larry Li – ZMJ America (General Manager)
Peter Jin – Sales Manager
Jianyong Mu - Engineer

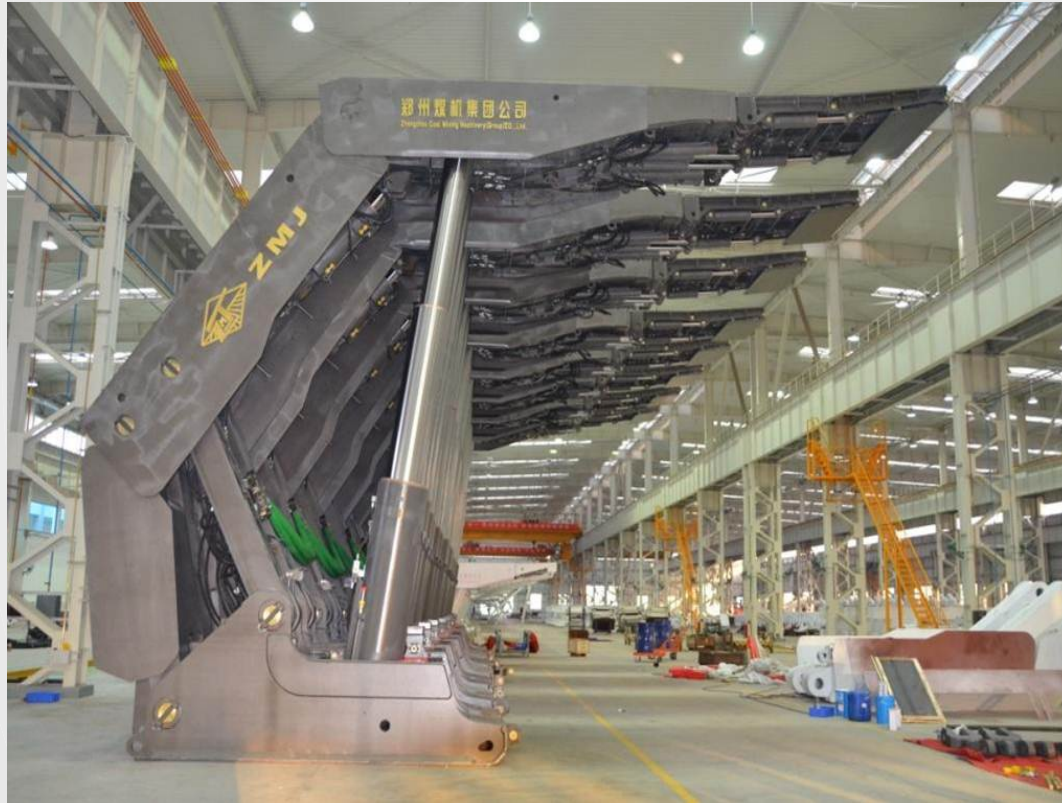
Tiefenbach North America

Chris Dulin - President

Mission Coal / Oak Grove Mine

David Ingle – Longwall Manager

Process of Buying *Chinese Shields*



Oak Grove Visit to China



ZMJ Visits Oak Grove



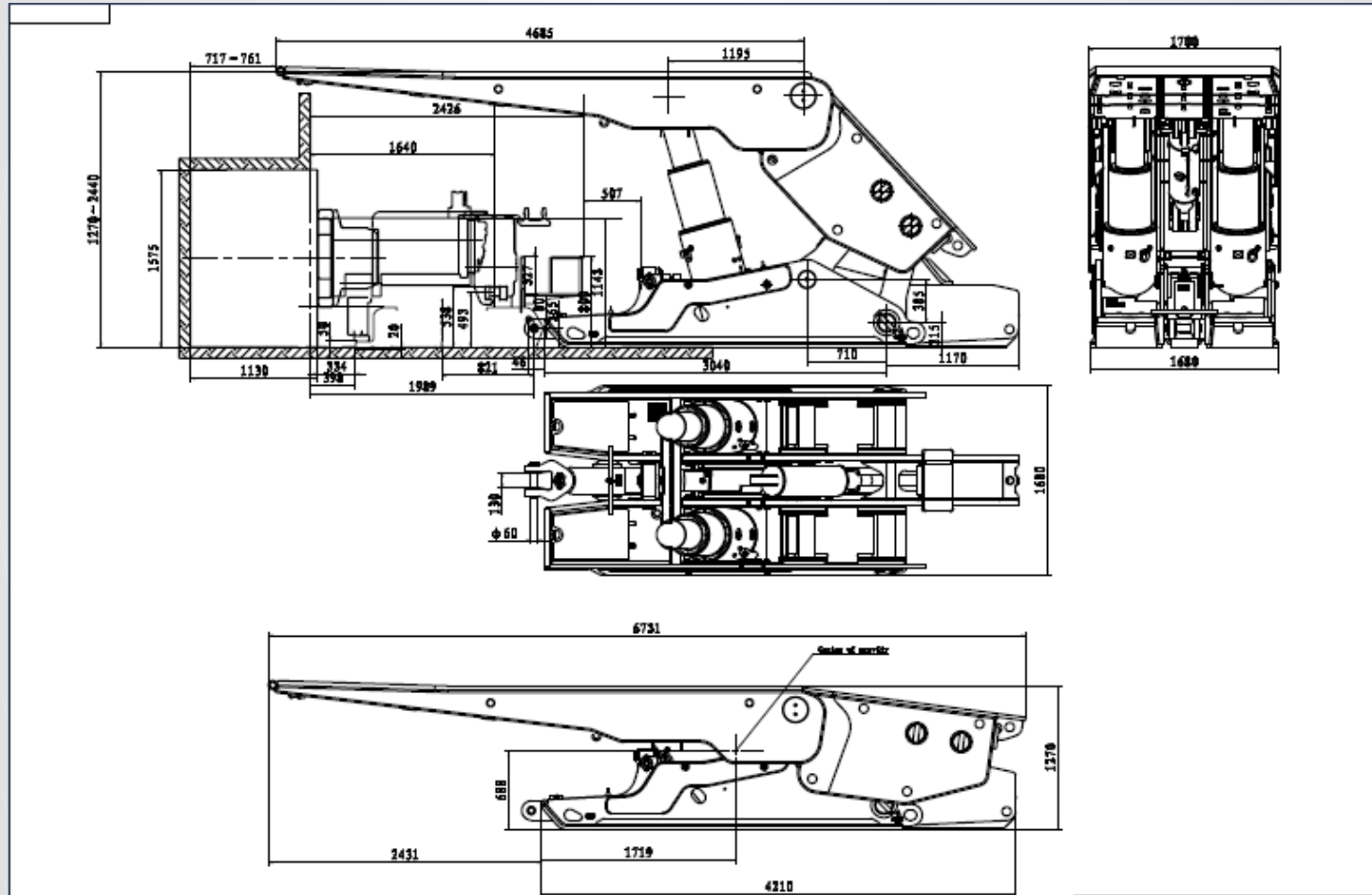
Shields supplied to Oak Grove Mine

May 4, 2016, ZMJ and Seneca Coal signed a contract for the supply of 204 longwall shields to Oak Grove Mine.



It was a breakthrough for Chinese coal mining machinery in the US market.

Specific Design



Structure features

- 66,000 cycles tested as per “CONSOL Standard” without cracks. Electro-hydraulically controlled.
- Fixed side shields at both sides.
- Walkway designed in front of the legs.
- Relay bar is constructed of a solid slab to meet the requirements of space arrangements of low seam shield.
- Leg cylinder diameter of Φ 400mm. Holes drilled on the wall of barrel and major stage. No port on piston rod.
- Applicable to 1.6m-2.2m low seam mining.

Main Technical Parameters

Description	Face Shield
Geometric Canopy Ratio	2.77:1
Tip to Face Distance before the cut	28.2 ~ 30 in.
Density at yield load Before Cut from 66 ~ 90Inches	10.06 ~ 10.66U.S.TONS/ft ²
Density at yield load After cut from 66 ~ 90Inches	8.42 ~ 8.93U.S.TONS/ft ²
Density at setting load Before Cut from 66 ~ 90Inches	7.24 ~ 7.68U.S.TONS/ft ²
Density at setting load After cut from 66 ~ 90Inches	6.06 ~ 6.43U.S.TONS/ft ²
Tip load under no load condition at the height of 66 inches	21.3 U.S.TONS
Vertical load Capacity at 96 Inches	9497.4KN(1068.3U.S.tons)
Travel way width at 96 Inches with Shield Advanced/Retracted	21.78in
Effective Cutting Web	42in

Main Technical Parameters

Description	Face Shield
Type of Shield (quantity of Legs)	Two-leg shielding type
Center Distance	1750mm (68.9in.)
Rated Working Resistance	10580KN(1190U.S.TONS)
Setting Load	7618KN(856.9U.S.TONS)
Pump station pressure	30.315MPa (4400 psi)
Maximum Extended Height	96 in.
Minimum Collapsed Height	48in.
Normal mining height	66 ~ 90in.
Transport Height	48 in.
Transport Length	264.44 in.
Leg Type	double telescopic
Leg Yield Pressure	6110psi
Leg Set Pressure	4400psi
Set to Yield Ratio	72%

Prototype Testing



The prototype shield was tested for 60,000 cycles as per Consol Standards. (66,000)

After testing 30,000 cycles the shield was disassembled and inspected. After reassembly another 30,000 cycles were run. The prototype was disassembled and inspected once again.

No cracks observed. Successfully obtained the customer acceptance.



Sl.no	Testing Item	First Phase	Second Phase
		Cycles	Cycles
1	Canopy: Offset Yielding Base: Bending (High position)	1000	1000
2	Canopy Torsion + Base Bending	4000	4000
3	Canopy Bending Base Three Point Loading	2000	2000
4	Canopy Side shield bending + Diagonal Loading	2000	2000
5	Canopy bending + Diagonal Loading	2000	2000
6	Canopy Maximum Torsion + Base dishing and bending	3000	3000
7	Canopy Transverse Bending + Base symmetric edge loading	3000	3000
8	Canopy hinge dishing + Base asymmetric edge loading	2000	2000
9	Canopy bending + Base transverse loading (front)	10000	10000
10	Canopy: Offset Yielding Base: Bending (Low position)	1000	1000
Total		30000	30000

Prototype acceptance and disassembly & inspection after shot-blasting







Measurements and Inspection Overseen by Oak Grove



Mass Production

Mass Production starts in May of 2016 with a delivery date of no later than end of November 2016 (7 Months)

Raw material would take one month to be delivered to ZMJ

6 weeks sea freight

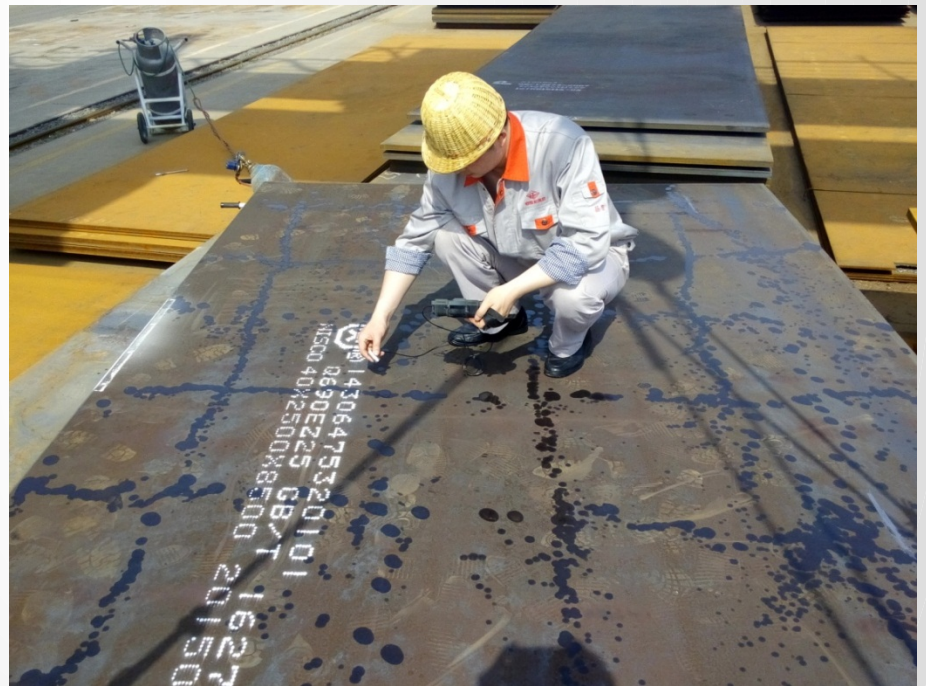
1 week overland in China

1 week overland in US

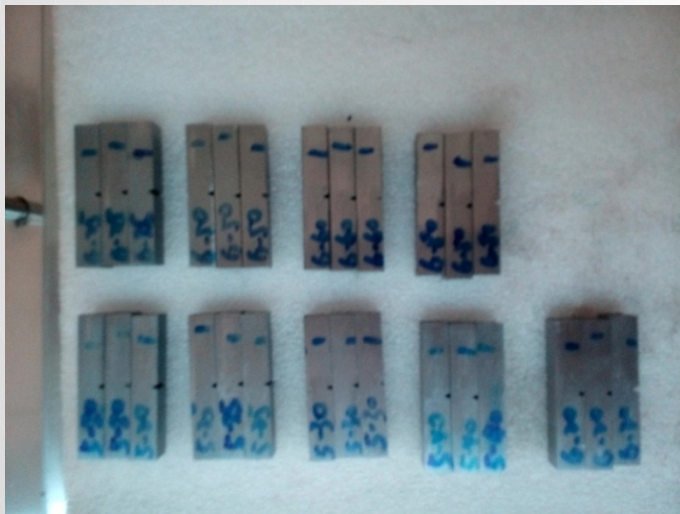
Quality must be upheld in all stages of production

Trace and Record during production

Sampling on the raw material; All material has tracking numbers for future tracking.



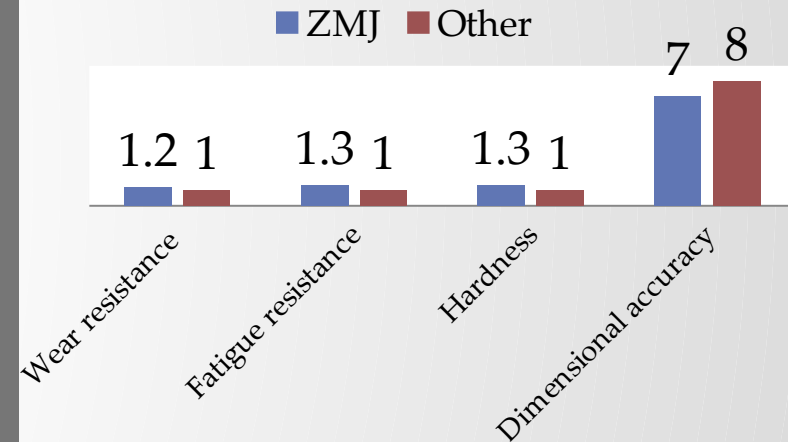
Inspection of the incoming raw material



Production Line of Leg and Ram

Cylinder Skiving and roller burnishing

Imported 4 skiving and roller burnishing machine from TACCHI, Italy And tools from ECOROLL, Germany, applicable to $\Phi 63 \sim \Phi 600$ mm cylinder.



Dimensional accuracy: H7; surface hardness increases 15 ~ 30%; fatigue resistance increases 15-20%; the life of sealing element increase 20-30%.

Production Line of Leg and Ram

Fully automatic CNC processing

Most advanced CNC machine tools, cutters and process technology.



Advanced two cutter CNC machine tools, the inner bore and external cylinder face can be processed at the same time, which assures the high auxiliary and accuracy, so as to increase the service life of leg and ram. ●

Production Line of Leg and Ram

Heat treatment production line

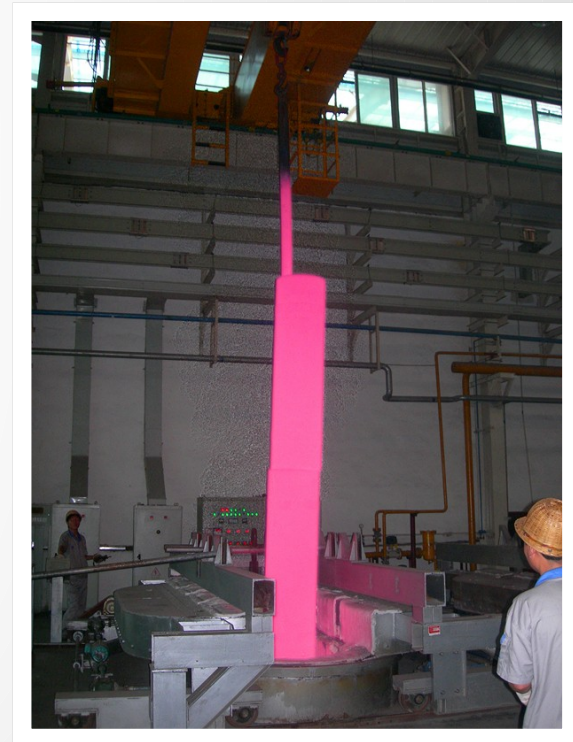
Adopt advanced heat treatment craft and box-type gas furnace for heat treatment, assure the mechanical property and quality stability of work piece.



Production Line of Leg and Ram

Heat treatment production line

Adopt initiative key slot type shaft furnace and special heat treatment attachment, assure uniformity of hardness and straightness accuracy .



Assembly Line of Leg and Ram

Advanced automatic washing equipment



Washing cylinder body and movable cylinder

Advanced assembly line



● Middle cylinder assembly

Movable cylinder assembly

Assembly completed ●

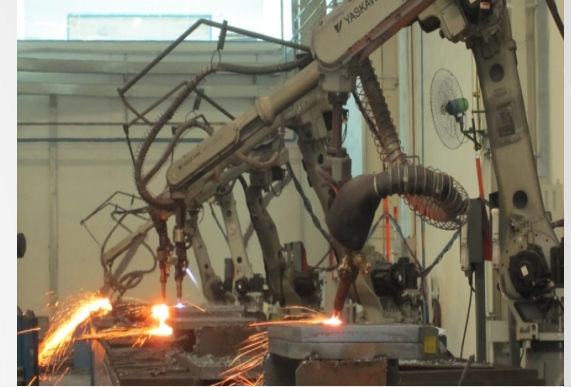
Production Line of Structures



Advanced shot blasting process equipment assure welding quality.



Internationally advanced CNC cutting machine from KOKIE, Japan and MESSER, German assure the dimensional accuracy of work piece;



International advanced bevel cutting robot improve the dimensional accuracy and assure welding quality;



Domestically advanced 9 roller 70000KN steel plate flattening equipment improve the flatness of material and assure assembly accuracy of structures;



Domestically advanced stiffened plate process equipment assure the assembly accuracy of structures;

Welding robots improved the welding efficiency.



Production Line of Structures



Adopt domestically advanced 8 shaft combination boring machine so as to assure the assembly ability of hinged joint hole ;



Domestically initiative automatic assembly platform in China, the assembly clearance can be controlled within 0~1.5mm, which greatly enhanced the assembly accuracy of structure and quality of work piece;

Production Line of Structures



ZMJ has 6 advanced large scale gas preheating furnaces, reduce the generation of hardened structure and hardness in heat affected zone, avoid post-welding hydrogen-induced crack and improve welding quality .

Production Line of Structures



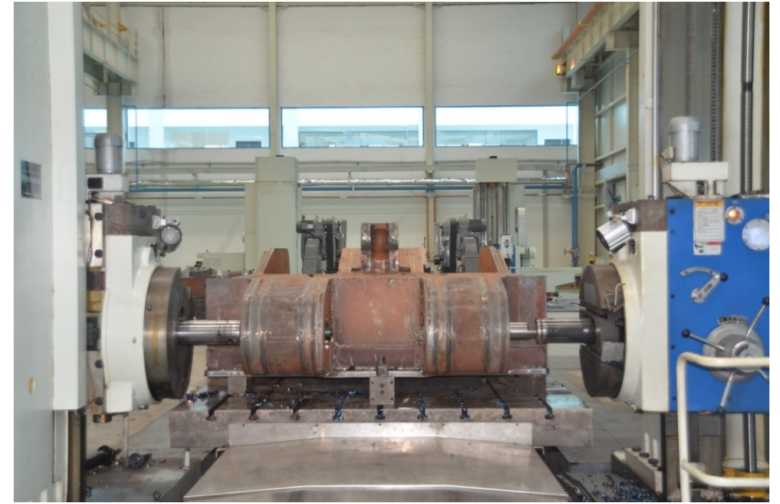
Imported welding robot from Cloos, Germany and Kobelco Japan, assure the design strength of welding line, eliminate human welding influence factors, stabilize and improve the welding quality, enhance mechanical properties of the overall structure

Production Line of Structures



Advanced large scale gas preheating furnace eliminate residual stress of weld joint, stabilize dimensional accuracy; reduce hydrogen content of welding point, eliminate hydrogen-induced crack; improve toughness of welding point, eliminate hardness of heat affected zone and improve the mechanical property of whole structure.

Production Line of Structures



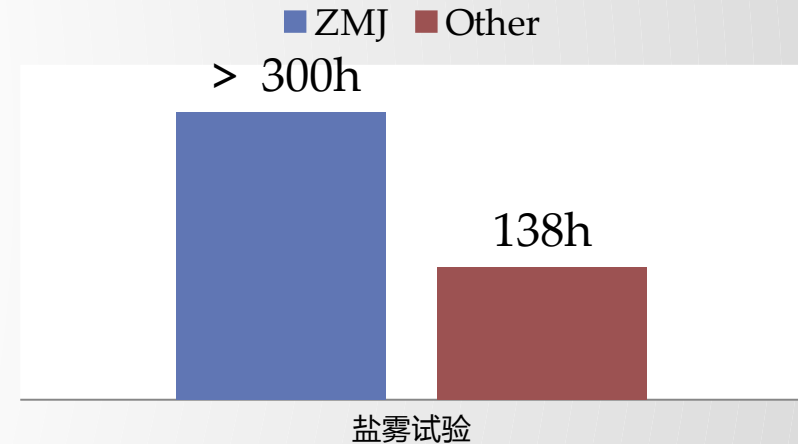
Advanced CNC special equipments increase accuracy of size and form & position, reduce tolerance clearance, enhance the stability of support; reduce internal force and lengthen the service life of support.

Production Line of Shot-blast and Spray Painting

Flow chart of cylinder shot blasting and spray painting production line



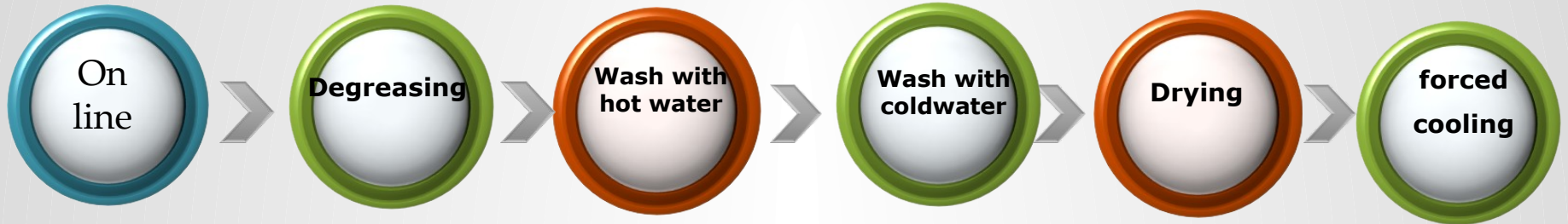
Cylinder shot blasting and spray painting production line



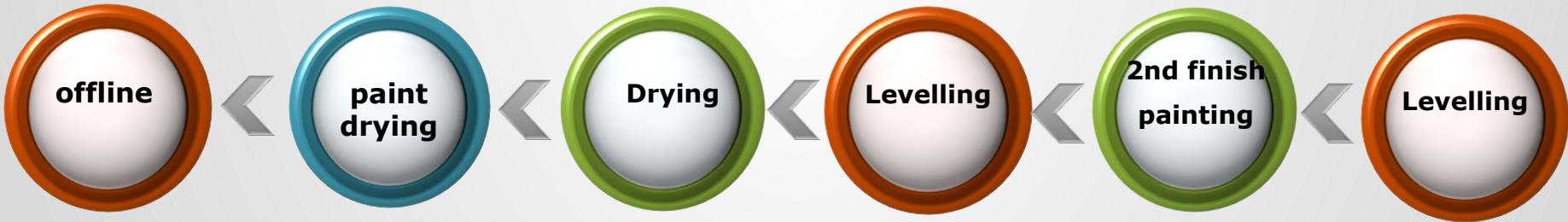
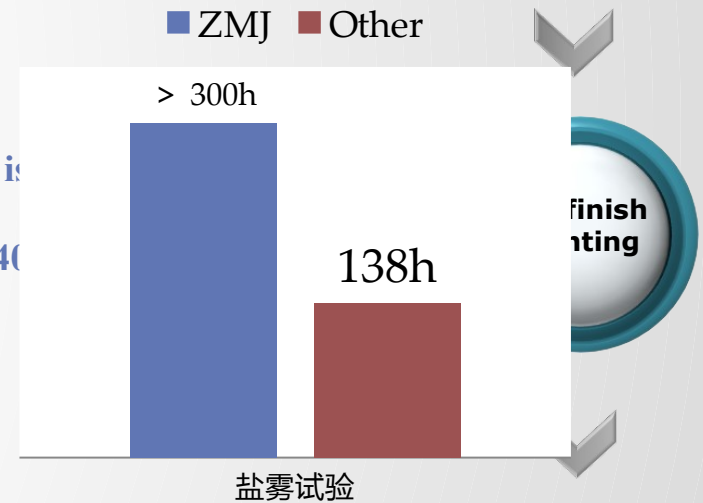
Type of paint: zinc-rich epoxy primer (JOTON)
Adhesive force: class 1, standard grid stratum disjunction area $\leq 5\%$;

Production Line of Shot-blast and Spray Painting

Spray painting line of finish paint for leg and ram



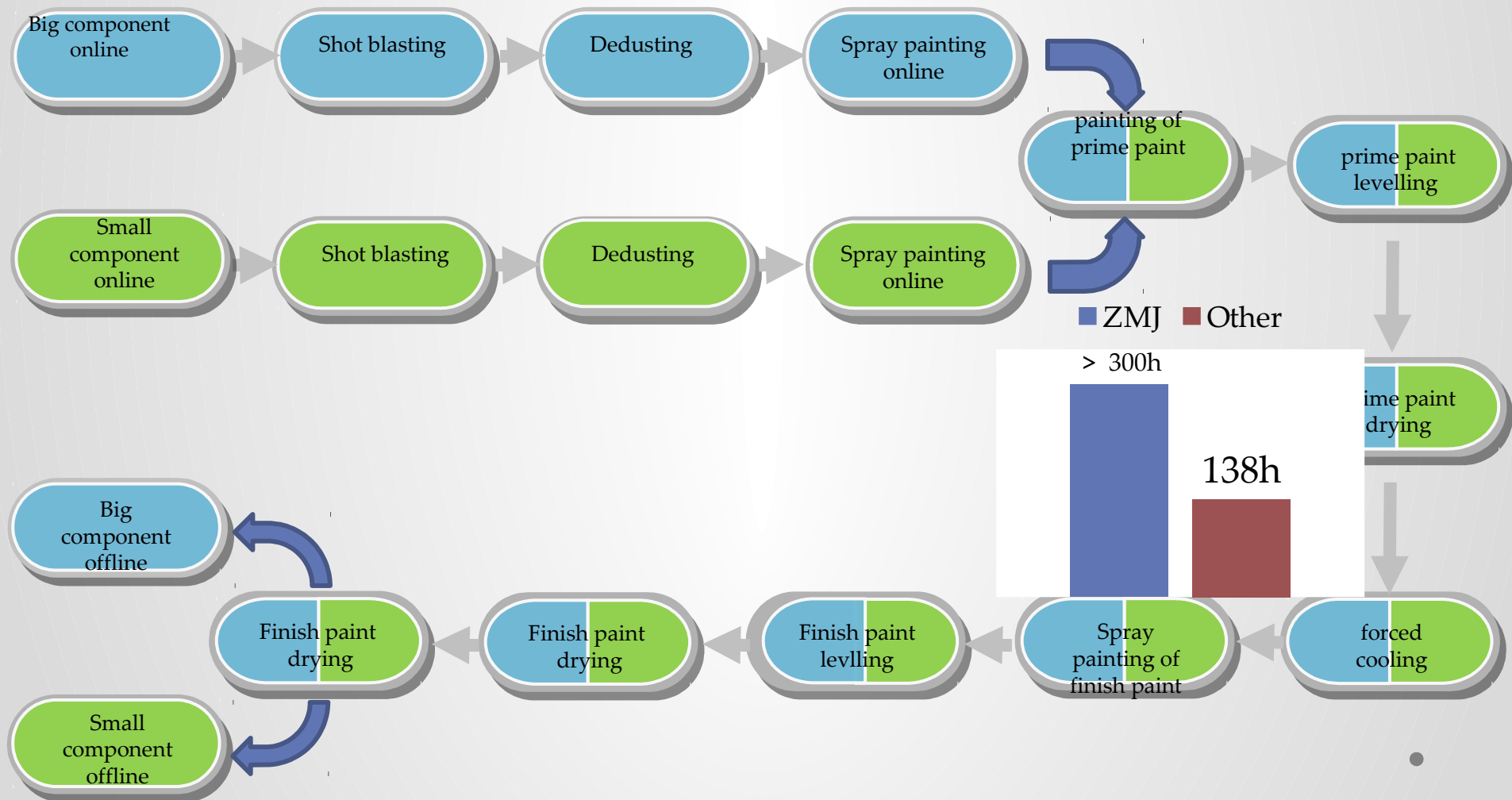
Flexibility: scrapings is elastic crimp
 Impact strength: > 40 N.cm



Production Line of Shot-blast and Spray Painting

Shot blasting and spray painting line for structures

Flow chart of Shot blasting and spray painting line for structures



Production Line of Shot-blast and Spray Painting



Shot blasting of
Small structures



Shot blasting of big
structures



Spray painting of
big structures

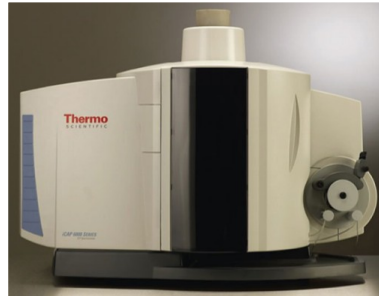
Advanced shot blasting and spray painting production line make the paint adhesive force of structures similar to car and the appearance quality of painting meet the requirements.

Quality Assurance

Raw material chemical composition test



spectral direct-reading spectrograph



ICAP 6300 Prodigy ICP

Raw material mechanical property test



JBDW-300C material impact test machine



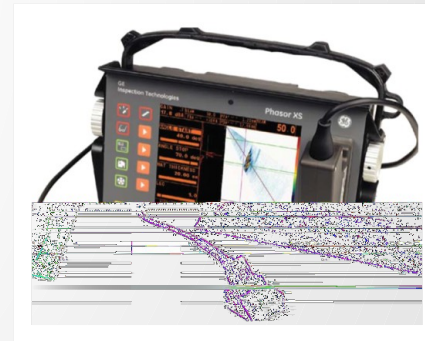
100 tons of electro-hydraulic tensile testing machine

Parts measurement and geometric accuracy test



Non contact type three coordinate measuring machine

Welding joint quality test



Portable ultrasonic phased array defects detector

Quality Assurance

Whole support life cycle test



Features of 30000KN test rig for support:

- ① **Automatically test the various function of support as per support type;**
- ② **Testing parameters are visual.**
- ③ **30000KN Max. loading 30000KN.**

30000KN test rig for support

Compatibility Test

Compatibility test was conducted at ZMJ facility to check the compatibility & functionality.



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Transportation Logistics

Multiple Sea Vessels

Flat Rack Containers

6 weeks at Sea

Less than 1 week from arrival to port to delivery to Oak Grove

Flat rack containers were used to transport the longwall shields.



Special fixing method used to secure the shield during transport

Lifting the shield

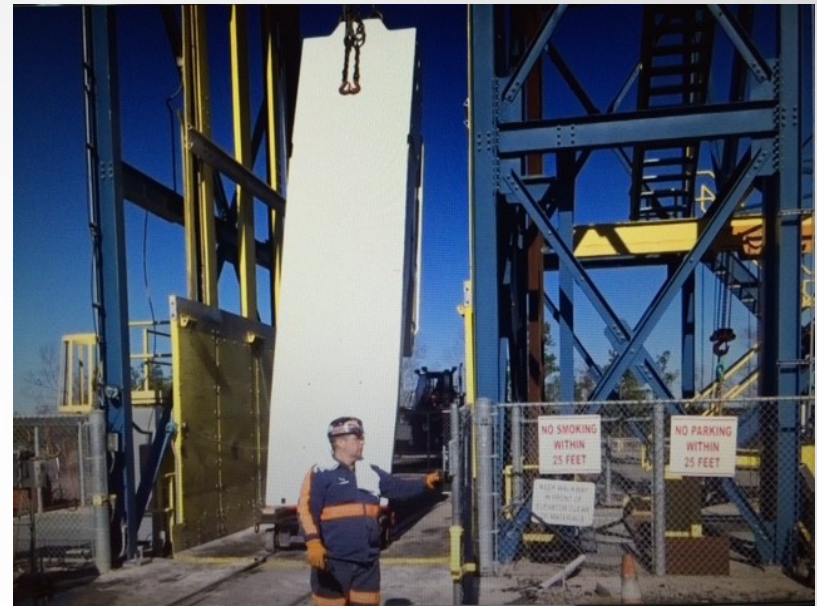


The first shield arrives at Oak Grove.

The longwall shields were delivered to Oak Grove Mine within specified time as per supply contract. ZMJ was invited to attend the ribbon-cutting ceremony at mine site.



Shields are lowered down and set on the face



Longwall Performance



18,000 ton per day
(3 Shifts)

Advancing 50' day

1088' Face

189 Shields

Gat Shields

(4 Tail)

(5 Head)

Questions

