LNSS

品质创造未来

Quality Creates Future

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辽宁三三工业有限公司
Liaoning Censcience Industry Co.,Ltd

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公司简介 About Us

辽宁三三工业有限公司(下称三三工业) 成立于2009年，专业从事盾构机/TBM隧道掘进机的研究设计、生产制造和销售，是国家级高新技术企业，拥有国家级盾构机/TBM隧道掘进机工程研究中心，是全球隧道掘进机行业“三巨头”之一，产品成为享誉中外的“复杂地质掘进机之王”。

2014年三三工业全资收购了世界500强美国卡特彼勒公司的子公司——加拿大卡特彼勒隧道设备有限公司的全部资产和知识产权，一跃成为全球隧道掘进机制造业领军企业。

三三工业是全球唯一一家可以生产土压平衡、泥水平衡、硬岩TBM、异形和垂直盾构机五大类盾构机的企业，产品直径从2m-24m，年产能100台。产品广泛应用于地铁、城市综合管廊、地下停车场、公路铁路隧道、水利工程、能源设施、地下军事工程等领域。产品已进入全国绝大多数建设地铁的城市，并远销美国、俄罗斯、英国、加拿大、土耳其、意大利、瑞士、西班牙、澳大利亚等国家和地区，特别是“一带一路”沿线国家。

中国第一台出口海外的盾构机、中国第一台出口欧美的盾构机、中国出口海外最大直径的盾构机、中国出口海外最小直径的盾构机，均由三三工业创造。

Liaoning Censcience Industry Co., Ltd (hereafter referred to as LNSS), set up in 2009, specialized in design, manufacturing and sales of Shield Machines / Tunnel Boring Machines , is the national high – tech enterprise , It also has the only national Shield Machines / Tunneling Boring Machines Engineering Research Center , it is also one of the “ Big Three ” in globally TBM industry . The products of LNSS could be deemed to be the “The King of Tunnel Boring Machines in Complex Geological Conditions”.

In 2014 , LNSS has successfully purchased all the assets and intellectual properties of Caterpillar Tunneling Canada Corporation , which is the wholly – owned subsidiary of Caterpillar Group which ranks top of Fortune World 500 , and becoming the global leader in manufacturing industry of Tunneling Boring Machines.

LNSS is the only enterprise which could produce five kinds of Shield Machines , such as , EPB Machines, Slurry Machines, Hard Rock TBMs , Non – Circular TBMs and Vertical Shield Machines . Diameter of TBMs ranges from 2m to 24m , annual production capacity could be 100 sets. LNSS branded TBMs have been widely used in fields of subway, urban comprehensive pipe gallery, underground parking , highway and railway tunnel , water conservancy project , energy facilities , underground military projects , etc . Until now, LNSS’ s products have entered into majority of domestic cities which are developing subway construction , and also have exported to U.S.A. , Russia , U.K. , Canada , Turkey , Italy , Switzerland , Spain , Australia , especially to the countries along the " One Belt And One Road " route.

The following records are created by LNSS , the First overseas TBM in China , the First exported to Europe and America TBM in China , the Largest Diameter overseas TBM in China , the Smallest Diameter overseas TBM in China .

Honors & Credentials
资质荣誉

●国家级荣誉

国家级高新技术企业	National-Level High-Tech Enterprise
国家级盾构机/TBM隧道掘进机工程研究中心	National Shield Machine/TBM Engineering Center
国家级知识产权优势企业	National-Level Intellectual Property Dominant Enterprise
国家级守合同重信用企业	National-Level Contract and Trustworthy Enterprise
国家级博士后科研工作站	National-Level Postdoctoral Research Center
国家级技术创新示范企业	Outstanding Product in China Machinery Industry
中国机械工业杰出产品	National-Level Technical Innovation Model Enterprise
中国优秀工业设计奖	China Excellent Industrial Design

●省级荣誉

辽宁省科技进步一等奖	First Class Prize for Liaoning Province Science and Technology Advancement Award
辽宁省就业先进单位	Liaoning provincial Employment Advanced Unit
辽宁省企业技术中心	Liaoning Provincial Enterprise Technology Center
辽宁省盾构机/TBM隧道掘进机工程研究中心	Liaoning ProvincialShield Machine/TBM Engineering Center
辽宁省诚信示范企业	Liaoning Provincial Good Faith Model Enterprise
辽宁省著名商标	Liaoning Provincial Well-known Trademark
辽宁省守合同重信用企业	Liaoning Provincial Contract and Trustworthy EnterpriseLiaoning
辽宁省五一劳动奖状	Provincial May 1st Labor Prize
辽宁省优秀新产品奖	Liaoning Provincial Outstanding New Product
辽宁省博士后创新实践基地	Liaoning Provincial Postdoctoral Innovation Practice Base
辽宁省工程技术研究中心	Liaoning Provincial Engineering Technology Research Center
辽宁省名牌产品	Liaoning Provincial Well-known Product
辽宁省辽宁慈善奖最具爱心捐赠企业	Liaoning Provincial Charity Prize – Best Love Donation Enterprise
辽宁省专精特新产品奖	Liaoning Provincial “Professional, Refined,Unique & Original” Product Prize
辽宁省重大研发成果奖	Liaoning Provincial Extraordinary R&D Achievement Prize
辽宁省省长质量奖	Liaoning Provincial Governor Quality Prize
辽宁省工业设计中心	Liaoning Provincial Industrial Design Center
辽宁省科技进步	Liaoning Provincial Science and Technology Progress Prize
辽宁省两化融合贯标试点企业	Liaoning Provincial Pilot Enterprise of Informatization & Industrialization Merging
辽宁省重点名牌产品	Liaoning Provincial Key Well-known Enterprise
辽宁省国际营销网络海外仓	Liaoning International Marketing Network Oversea Location
辽宁省产业专业技术创新平台	Liaoning Provincial Industry Technical Expertise Innovation Platform
2018年科学技术奖	2018 Annual Science & Technology Prize
辽宁省“兴辽人才”计划	“Talents for Liaoning Province Revitalization” Program
辽宁省服务型制造示范企业	Liaoning Provincial Service-oriented Manufacturing Model Enterprise
辽宁省制造业创新中心	Liaoning Provincial Manufacturing Industry Innovation Center

Honors & Credentials
资质荣誉

Applications of TBM 盾构机应用领域：

主要应用于铁路、公路隧道、海底隧道、城市地铁隧道、城市下穿隧道、地下停车场、综合管廊、石油、污水管道、煤巷道施工以及防护工程建设领域、业务开展遍布全球。

Our tunneling business expands around the world, and the main application of our products and service is in Railway and Road Tunnel, Subsea Tunnel, Urban Metro Tunnel, Urban Underpass Tunnel, Underground Parking Garage, Utility Tunnel, Oil and Sewage Tunnel, Coal Mining Tunnel, and Protective Construction.

产品门类 Product Category

- 土压平衡盾构机
  EPB(Earth Pressure Balance) Shield TBM
- 泥水平衡盾构机
  SPB(Slurry Pressure Balance) Shield TBM
- 硬岩TBM
  Hard Rock TBM
- 煤炭巷道掘进机
  Coal Mining TBM
- 异形盾构机
  Special Shape Shield TBM
- 垂直盾构机
  Vertical Shaft Shield TBM (VSM)

Earth Pressure Balance (EPB) TBM
土压平衡盾构机

Tunneling Underground Space Creating Wonderful Life
掘进地下空间 创造美好生活

在不同的地区，不同的城市，施工环境都不一样。尤其是在华南，西南等地区的城市，工程地质变化多样，上软下硬以及局部全断面硬岩的情况非常常见。传统盾构机只能够应对单一地层，遇到复合地层往往无法保证高效的掘进速度与效率。复合式土压平衡盾构机既能在均一的地层下有高效的掘进速度与施工效率，又能在上软下硬、卵石、全断面硬岩等复杂地层同样保持高效的掘进速度与施工效率。

Tunneling construction environment will be various in different cities and fields, especially in the cities of South China and Southwest China, in which the geological conditions are diverse, commonly encountering Mixed Ground (Upper Soft and Lower Hard Ground) and Full-Face Hard Rock Ground within certain section. Conventional shield machine could only tunnel under ideal characteristics stratum, and the advance rate and construction efficiency could not be maintained under mixed ground. Our Mixed EPB Shield Machine could not only mine under ideal ground with high advance rate and efficiency, but also mine under mixed characteristics stratum, such as Upper Soft and Lower Hard Ground, Pebbles, and Full-Face Hard Rock Ground, maintaining the same high advance rate and efficiency.

●稳定的掘削面

使土舱内充满掘削后的渣土，再注入添加剂使掘削面保持稳定。

土压盾构机针对透水系数大的土质情况对添加剂进行不断改良，增加了土压平衡盾构机对地层的适应性。

●进化的延续

在土压盾构机的优良性能上，针对复杂地层，开发了高效率掘削的双模式盾构机，用于地铁工程，实现了月进度600米以上的高速掘进。

Stabilized Work Face

Earth chamber is filled with muck and mixed with ground conditioning additives to stabilize the work face.
By means of constantly modifying the ground conditioning addiclives against high soil permeability,the suitability of EPB TBM to the relevant ground has been improved significantly.

Constant Improvement

For complex ground, we developed highly efficient dual-mode TBM for metro tunnel construction, and achieved >600m monthly advance rate.

高强度刀盘

（1）采用了有限元分析设计方法，刀盘结构创新的采用了Q690+Q345B高强度结构钢，提高刀盘的强度和刚度。
（2）刀盘开口率可变技术，适应不同地层的快速掘进。
（3）首创使用双层冶金复合耐磨板作为耐磨材料。

大功率、高扭矩主驱动

（1）盾构机的最大掘进速度提高了20%；保证了盾构主机内适宜的工作环境及温度，提高了施工人员的舒适性。变频电机传动的效率可达到95%，远远高于液压驱动的70%-80%的传动效率,能耗损失小。
（2）独创性采用液压油作为主驱动密封油，同时兼顾润滑，降温及提前检测的功能。
（3）主驱动密封即可使用HBW油脂进行密封也可使用EP2油脂进行密封，根据不同的地层情况可以使用不同的油脂，减少施工成本。

新型推进系统

（1）主机推进油缸任意分组，主推的每根油缸可以实现压力、流量的单独或任意成组控制。
（2）三三的盾构机的姿态控制更灵活更方便，效率可提高至少50%。

新型管片吊装系统

（1）独创了三三工业专有专利技术的新型单轨梁式管片吊机，主要由行走机构、起升机构、管片行走小车、管片拾取机构组成。行走机构为液压马达驱动，链轮链条传动；起升机构由起升油缸采用钢丝绳通过一系列滑轮组提升管片拾取机构；管片拾取机构为机械式，操作方便，性能稳定可靠，管片吊运系统具有可操作性强、可靠度高、维修简单方便、施工效率高的优点。平均每环管片运输的时间可节约10分钟。
（2）其他核心的电气及控制系统、液压集成技术、数据采集系统技术等均为三三工业自主研发，拥有多项专利权及独有技术，复合式土压平衡盾构机在国际上处于领先地位。

High Strength Cutting Head

(1)Cutting head structure is fabricated with high strengthsteel (Q690+Q345B) to improve the strength and stiffness, which will beverified by FEA simulation.
(2)The opening ratio of cutting head is variable, to maintain high advance rate under various ground conditions.
(3)Pioneering use of double layers compound wear resistantplate as anti-wear material.

High-Power and High-Torque Main Drive (VFDDrive)

(1)With the powerful main drive system, the Max advance rate couldbe improved 20%, TBM internal working environment and temperature could bemaintained well, and comfort of operators could also be increased. The transmissionefficiency of VFD E-motors could reach 95% with less power loss, which is muchhigher than hydraulic motors drive (only 70%-80% transmission efficiency).
(2)Exclusively select hydraulic oil as main drive sealing oil,meanwhile fulfilling lubrication, cooling and inspection functions.
(3)Either HBW grease or EP2 grease could be applied to maindrive seals, according to different ground conditions to reduce constructioncost.

New Model Propulsion System

(1)TBM propel cylinders could be randomly grouped, and thepressure, flow of propel cylinders could either be under individual control orgrouped control.
(2)Gestures control of our TBM could be moreconvenient and flexible, which is able to increase 50% efficiency.

New Model Segment Handling System

(1)LNSS exclusively designs new model mono-beam segmenthandling system with its own IP, comprising of traveling mechanism, lifting mechanism,segment trolley and segment pick up mechanism, Traveling mechanism is driven byhydraulic motors and transmitted by chains and sprockets; Lifting mechanismhoists segment pick up mechanism by lifting cylinders with wire rope through pulleyblocks; Mechanical type of segment pick up mechanism, convenient to operate andhigh reliability. The features of this segment handling system are highoperability and reliability, easy to maintain and high construction efficiency.In average, 10 minutes will be saved for segments transportation period perring.
(2)LNSS also exclusively designs and develops other essentialelectrical and control systems, hydraulic integration technology, and data acquisitionsystem. LNSS has international leading technology in Mixed EPB Shield Machinetechnology, with multiple patents and exclusive intellectual properties.

Slurry Shield TBM
泥水盾构机

Tunneling through rivers and oceans
Transferring chasm into thoroughfare
穿江越洋 天堑变通途

直径从3米到18米，重量300-5000吨，可根据地层情况采用常压换刀技术，在正常大气压下即可更换刀具。

●稳定的掘削面

设备采用气-液平衡式泥水盾构机，向开挖仓和气垫仓内注入高比重，高粘度的泥浆，保证掌子面形成泥膜，再向气垫仓内注入保压气体，保证掌子面的稳定，可有效控制沉降。

●超大口径掘进

通过周边支撑、中间支撑型构造实现了宽广的机内空间，从小口径发展到超过18米的超大口径。

Diameter range of machine covers from 3m to 18m, with respective weight from 300t to 5000t. Atmospheric intervention is adopted based on geological condition. Cutters could be replaced under atmospheric pressure.

Stabilized Tunneling Face

Air-Slurry balanced slurry shield machine is selected , and the slurry with high specific gravity, high viscosity is injected into working chamber and air cushion chamber to form a fully covered mud film on tunneling face. Then air for maintaining pressure is injected into air cushion chamber to maintain the stability of tunneling face and control ground settlement well.

Super Large Size TBM

Through surrounding support, center support structure, the machine internal operating space has been widely enlarged, from small size to over 18m super large size.

主要技术优势 Main Technical Features

●高强度刀盘 High Strength Cutting Head

（1）采用了有限元分析设计方法，刀盘结构创新的采用了Q690+Q345B高强度结构钢，提高刀盘的强度和刚度。
Cutting head structure is fabricated with high strength steel (Q690+Q345B) to improve the strength and stiffness, which will be verified by FEA simulation.

（2）刀盘开口率可变技术，适应不同地层的快速掘进。
The opening ratio of cutting head is variable, to maintain high advance rate under various ground conditions.

（3）首创使用双层冶金复合耐磨板作为耐磨材料。
Pioneering use of double layers compound wear resistant plate as anti-wear material.

●常压换刀技术
Atmospheric Intervention Technology

采用旋塞换刀阀装置，采用独有的密封技术及刀具自动伸缩机构，使刀具与土仓隔离，将作业面移至常压区域，节约空间，避免了泥水平衡盾构机带压换刀存在的安全风险。
The system comprises of cutter intervention plug valve, exclusive sealing technology and cutter automatically telescopic mechanism, which will isolate cutter with earth chamber, transfer the operation area to atmospheric zone, save working space and avoid safety risk caused by SPB hyperbaric intervention.

●刀盘驱动伸缩及摆动技术
Cutting Head Main Drive Telescopic and Swinging Technology

（1）采用三三工业独有的刀盘驱动伸缩及摆动关键技术，主驱动增加油缸控制的伸缩机构，可有效的解决硬岩地层下更换新刀的安装空间问题，缩短了带压换刀作业时间，提高人身安全。
LNSS exclusive cutting head main drive telescopic and swinging technology has been adopted, in which cylinders controlled telescopic mechanism has been equipped on main drive system, to effectively solve working space issue of cutter intervention under hard rock ground, cut down working time of cutter hyperbaric intervention and improve operator security.

（2）还可以解决盾构机的在磨含钢筋的混凝土桩时钢筋缠绕刀盘，有效解决刀盘卡死的问题。
Prevent reinforced bars within concrete piles wrapping cutting head when the cutters cut concrete piles, which will effectively solve cutting head stuck issue.

（3）独创性采用液压油作为主驱动密封油，同时兼顾润滑，降温及提前检测的功能。
Exclusively select hydraulic oil as main drive sealing oil, meanwhile fulfilling lubrication, cooling and inspection functions.

（4）主驱动密封即可使用HBW油脂进行密封也可使用EP2油脂进行密封，根据不同的地层情况可以使用不同的油脂，减少施工成本。
Either HBW grease or EP2 grease could be applied to main drive seals, according to different ground conditions to reduce construction cost.

●主驱动密封系统 Main Drive Sealing System

（1）该密封系统采用PLC自动控制分级加压模式，工作过程中，PLC会采集配置在唇型密封前腔内压力传感器的压力，自动控制后面各个密封腔的压力，达到逐级减压最终确保土舱杂质不进入主轴承的目的。
Main drive sealing system adopts an automatic PLC control mode to allocate the encountered earth pressure to each stage. During operation, PLC will acquire earth pressure from pressure sensor within lip seal cavity, and the pressure within the following seal cavities will be controlled and reduced automatically to avoid the impurities in earth chamber entering into main bearing.

（2）独创性采用液压油作为主驱动密封油，同时兼顾润滑，降温及提前检测的功能。
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Either HBW grease or EP2 grease could be applied to main drive seals, according to different ground conditions to reduce construction cost.

●气垫仓保压技术
Pressure Maintaining Technology within Air Cushion Chamber

采用膨润土-气垫技术通过使用主开挖室后面的一个分隔的气垫室精确地控制开挖室及盾构前方的压力，能在盾构运行过程中精确的控制地表沉降。
Bentonite-Air Cushion technology has been adopted to precisely control the pressure within working chamber and in front of cutting head through a separated air cushion chamber behind working chamber, which will precisely control ground subsidence during tunneling process.

其他核心如管片运输系统采用成熟的复合式土压平衡盾构机的专有技术，电气及控制系统、液压集成技术、数据采集系统技术等均为三三工业自主研发，拥有多项专利权及独有技术，异型盾构机产品在国际上处于领先地位。
Other core TBM systems, such as segment handling system, will adopt proven exclusive Mixed EPB TBM technologies, electrical and control system, hydraulic integration technology, and data acquisition technology, which are all developed exclusively by LNSS with multiple patents and unique technology. The special application TBM technology is in leading position around the world.

硬岩掘进机 Hard Rock TBM

Maximum Size Hard Rock TBM Exported from China
中国出口海外直径最大硬岩TBM

●适应于地质的刀盘形状

根据岩石的量、口径大小、强度和岩石的特性等条件可以选择平坦型或是半圆型的刀盘。

●在前面破碎、还是吞入

刀盘开口槽的形状有在刀盘前面将砾石破碎后吞入土舱方式的前面破碎型，也有尽可能的将大砾石吞进土舱的吞入型。

●滚刀的选定

在硬岩层中采用了在TBM上有丰富使用业绩的滚刀。在沙砾层中为了延长刀盘的寿命，采用了内置超硬刀片的滚刀，这些滚刀能在土舱内部便捷地进行更换。

Tailor Designed Cuttinghead
The Cuttinghead can be designed as cantilever or drum type based on different rock formation and characteristics.

Rock Breakage
The rock can be broken by cutting tools in front of cuttinghead and collected into the cutting chamber, boulders can also pass through the cuttinghead based on specific cuttinghead opening design.

Disc Cutter Selection
Top quality and highly durable disc cutters for rock mining, equipped with high strength cutting rings to extend its usage life, which can be back loaded from within the cutting chamber.

Coal Mining TBM
煤炭巷道掘进机

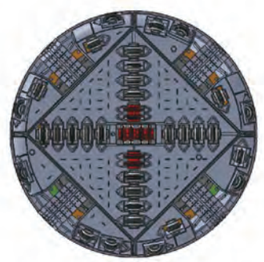
Breaking International Tough Challenge of Mining Under Hard Rock Coal Mine
破解煤炭井下硬岩掘进世界性难题

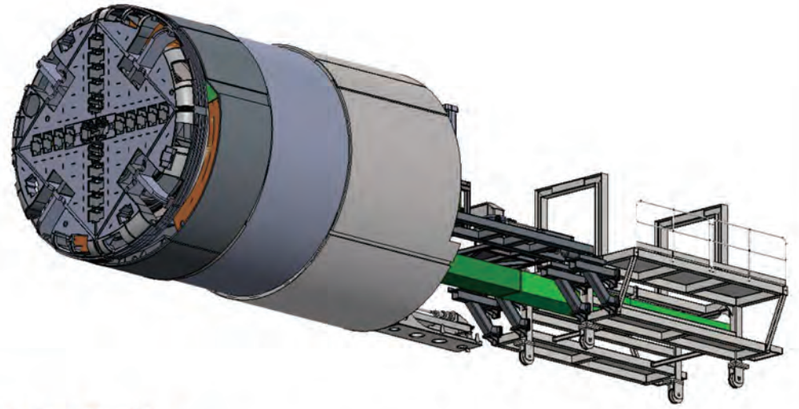
●全断面煤矿TBM（振兴一号）

本岩巷掘进机利用全断面刀盘一次破岩成洞，将TBM掘进机与煤矿运输、支护等特殊施工要求相结合，集掘进、出渣、支护、除尘、通风、导向、防爆技术于一体，本项目的掘进机适用煤矿的小转弯半径，变向灵活，设备适应软岩、硬岩等多种地层掘进，适合煤矿的地层多变性。

●Full Face Coal Mining TBM (Revitalization No.1)

This Rock Drivage TBM integrates mining, muck removing, bracing, dedusting, ventilating, guiding and explosion-proofing technologies together, and it takes advantage of a full face cutting head to excavate and break through the roadway in one time, combining the TBM with mining peculiar facilities, such as mine transportation and bracing equipment together. The mining TBM for this project is suitable to negotiate in small curvature radius and can also be applied to mining under multiple grounds, such as soft rock and hard rock stratum. This machine is compatible with ground variability of coal mine.





煤炭巷道掘进机参数 Parameters of Coal Mining TBM

主要技术参数表 Main Technical Data Sheet				
序号 No.	项目名称 Project Name	参数 Parameter	单位 Unit	备注 Remarks
1	整机主要指标			
1.1	适用地层及岩石硬度	f4～f10	普氏系数	煤岩、软岩、硬岩
1.2		40～100	MPa	
1.3	开挖直径	5800	mm	
1.4	最大爬坡能力	5	°	
1.5	最小转弯半径	70	m	
1.6	主驱动功率	1000	KW	
1.7	主驱动转速	0～7	rpm	
1.8	驱动扭矩	3500	KNm	
1.9	脱困扭矩	4000	KNm	
1.10	最大总推力	13000	KN	
1.11	额定推进速度	20	mm/min	
1.12	最大推进速度	50	mm/min	
1.13	主机长度	9	m	不含指形护盾
1.14	设备总长	≤30	m	
1.15	冷却水量	25～30	m3/h	客户提供
1.16	冷却水进水温度	≤35	℃	
1.17	总装备功率	2100	KW	

垂直盾构机 Vertical Shield Machine

Underground "Aircraft Carrier" of Engineering Machinery
工程机械地下“航空母舰”

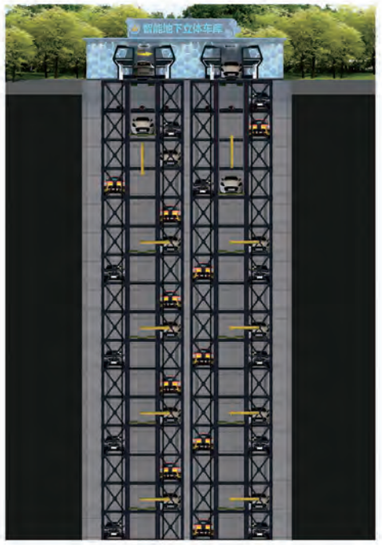
直径7米到24米，在垂直掘进过程中同时完成管片支护，一次成型，应用于矿山、煤矿、地下停车场竖井掘进，效率高。

The designed cut diameter of our VSM could be from 7m to 24m, and it is able to accomplish one time segment lining support during vertically mining process with high efficiency. The machine could be applied to mining industry, coal mine and shaft excavation for underground parking garage.

全自动垂直盾构机是三三工业自主研发设计的高智能、高效率、机电液一体化产品，主要应用于地下智能停车场、有色金属矿山、煤矿、军工等垂直深隧的掘进施工，产品彻底改变传统竖井掘进方法，开辟了全新的垂直盾构施工工法。

The automatic vertical sinking shield machine is an independent design and development product by LNSS, integrating mechanical, electrical and hydraulic engineering, with features of high intelligence and high efficiency. This machine is mainly applied in vertical tunnel mining, such as underground intelligent parking garage, non-ferrous metal mine, coal mine and military facility. This new type of vertical sinking machine will completely change conventional shaft boring principle, and create a new vertical sinking shield construction method.

主要技术优势 Main Technical Features



●井下无人值守，打井不下井，避免人工打井的危险性。
Unattended shaft vertical excavation, operator will not need to go down and engage in excavation process, so personnel safety risk could be avoided.

●设备结合沉井法与盾构法施工，采用全新形式的开挖刀盘，泥浆排渣，沉管支护与于泥浆护壁技术等掘进技术保证掘进安全高效，地质条件适应能力强。
This machine will integrate segment lining sinking method with shield construction method, and fully new model cutting head, slurry discharging, sinking segment lining shield and grouting injection technology will be adopted to guarantee the tunneling will be under security and high efficiency. This machine is suitable to various geological conditions.

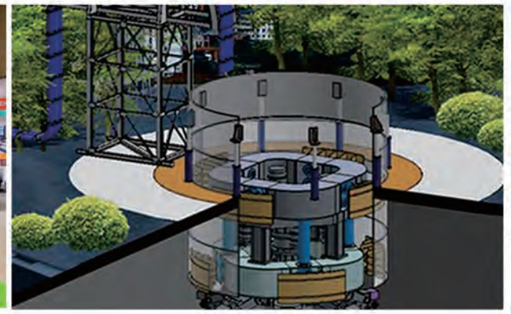
●设备配置刀具磨损量实时监测，在掘进过程中对刀具磨损实时监测，不需要人工检查刀具磨损情况。
The abrasion loss of cutters could be monitored in real time during excavation process. No manual inspection will be required.

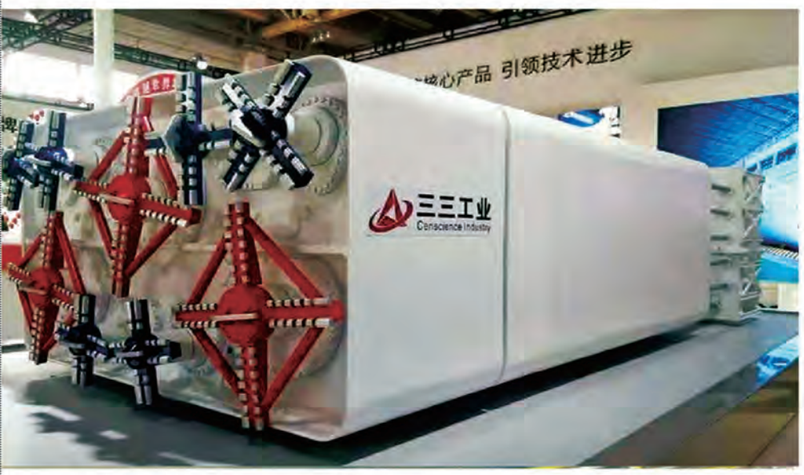
●泥水环流排渣，模块化泥水处理系统，占地面积小，设备安装、拆机灵活，转场方便。
Slurry will be discharged in circulation mode, and modular slurry treatment system will be used with features of compact design, being flexible to install and disassemble, and convenient to deliver.

●盾构法竖井掘进 Shaft Vertical Boring with Shield Method
结合盾构法的掘进理念和沉井法的支护方式，同步完成竖井掘进与去护，盾壁外注入膨润土，形成泥浆护壁，全面提高竖井掘进的安全性。
It will integrate the mining principle of Shield method with lining sinking method, to accomplish shaft mining and lining sinking simultaneously. Bentonite will be injected into the circular lining outside of surrounding rock to form slurry wall shield and increase the security of vertical mining process.

●全自动智能控制 Automatically Intelligent Control
全新的掘进模式，掘进设备全部自动化、智能化，全面监控掘进过程，真正做到“打井不下井”
It is a completely new mining mode, and all the mining equipment could be in automated and intelligentized control. The whole mining process could be fully monitored. Operator will not need to go down and engage in shaft excavation process.

●大直径全地层覆盖 Large Excavation Size and Full Geologies Application
突破传统钻机的开挖直径限制和地质条件的限制，可开挖直径七米以上的竖井，地质条件适应广泛，环保高效。
This machine breaks the excavated diameter and geological limit to conventional shaft digging machine, which is environmental-friendly and applicable to excavate shaft with excavated diameter over 7m and various geological conditions.





Special-Shape Shield TBM
异形盾构机

Challenge Solver against Tunneling Under Urban Underpass
城市下穿隧道方案解决者

●根据地形、用途完全专门订制

能够根据尺寸及地质条件，针对特殊地形条件进行专门订制。

●阿波罗刀盘施工法（包含着所有可能性的回旋刀盘）

能掘削以矩形为主的任意断面，也适用于非圆形或圆形断面。刀盘构造上有高性能的刀具位置控制机构来确保高精度的掘削断面。

●特长

① 能掘削圆形、矩形、马蹄形等自由断面
② 在掘削硬质地形或地下障碍物时发挥威力
③ 刀盘构造部分可以再利用至其它盾构机上

Customized TBM Design Based on Different Usage and Geological
ConditionsCustomized TBM Design is provided based on size required and specific geological conditions

Apollo Cuttinghead method
Capable of excavating rectangular section, also suitable for circular and non-circular sections. The cuttinghead is equipped with high precision cutting tool location control system to ensure cutting accuracy.

Special Features:
1. Capapble of excavating circular, rectangular, rectangular and horse-shoe shaped sections.
2. Highly efficient when mining through hard rock formations and underground barriers.
3. The cuttinghead structure can be reused on other type of TBMs.

Engineering Center
研究中心

Research & Design in 24hrs Working Mode
研究设计24小时运行接力

●科技研发

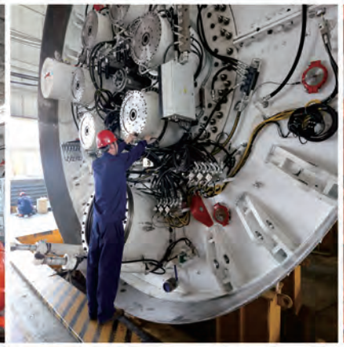
三三工业设有总部、沈阳、加拿大3大研发中心，其中总部研发中心下设土压、硬岩、泥水、特种设备、电气、液压、工艺等研究所，拥有一支专业的盾构机研发设计团队，并与中科院金属研究所、北京大学、上海交通大学、东北大学等高校建立了广泛的产学研合作。目前，已获得盾构机发明专利、实用新型专利170余项。国内外研发团队互动互融、同创同新，实现全球科研团队24小时运行接力。

Technology Engineering

There are three engineering centers located separately in LNSS HQ, Shenyang and Canada. The engineering center located in HQ comprises of Earth Pressure Balance (EPB),Hard Rock, Slurry Pressure Balance (SPB), Special Application Equipment,Electrical, Hydraulic, and Engineering Process Departments. LNSS owns a specializedTBM engineering design and development team, and it also undertakes industry-university-research cooperation with Metal Research Institute of ChineseAcademy of Science, Peking University, Shanghai Jiaotong University, andNortheast University. Nowadays, the company has already earned around 170invention patents and utility type patents regarding tunneling equipment. The mutualintegration, collaboration and innovation between domestic and overseasengineering team achieve global 24hrs relay working mode.

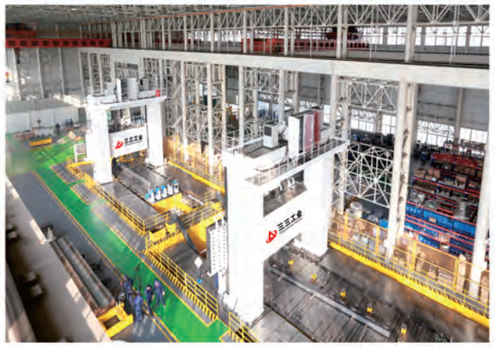
Processing Capacity
加工能力

下料 Material Cutting → 卷板 Plate Rolling → 焊接 Welding



Manufacturing Capacity
制造能力

机加 Machining → 部装 Sub-Assembly → 总装 Final Assembly



Domestic TBM Achievements
国内TBM业绩

杭州市文一路提升改造工程

深圳地铁9号线

重庆地铁10号线

大同煤矿工程

长春地铁1号线

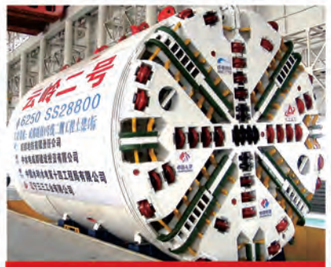
成都地铁4号线

南京地铁4号线

南京地铁4号线

长春轨道交通1号线03、04标段

成都地铁4号线工程

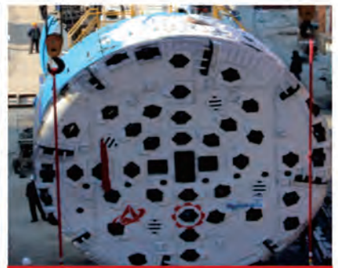


成都地铁4号线工程西延线

北京地铁9号线

兰州地铁隧道工程

成都地铁4号线西延线


新疆引额尔齐斯河引水工程

Other Domestic TBM Projects Reference
国内其它重要业绩

序号 NO.	投入使用时间 Year	项目名称 Project Name	地质条件及业绩描述 Geological Conditions Performance Description
1	2014	深圳地铁9号线	地质条件上软下硬，花岗岩硬度达到190 Mpa，涌砂喷水。137根楼房桩基础，岩石为12-4花岗岩三三工业盾构机连续穿越137根楼房桩基础，创造了地铁施工领域首次在极端条件下密集穿越建筑物桩基群的世界纪录。
2	2014	成都地铁4号线	三三工业盾构机傲视群雄，创造了月进尺370环（555m），最高日进尺20环（30m）的记录。
3	2015	西安地铁4号线	三三工业制造的大功率、大扭矩、高速度的两台"秦龙号"盾构设备配置远高于行业内其它同系列产品，保证了盾构机在穿越涵洞铺道时有效地控制地面沉降，最终超预期完成了盾构下穿高铁沉降控制目标。
4	2015	南京地铁4号线	三三工业采用土压平衡盾构机代替硬岩TBM施工，创造了平均日进尺5环的硬岩掘进最新记录。
5	2015	成都地铁4号线西延线	该区间属于高富水、大粒径、高强度、胶结性差漂卵石地层。三三工业盾构机傲视群雄，创造了月进尺370环（555m）、最高日进尺20环（30m）的记录，掘进速度是竞争对手的1.5倍。
6	2015	重庆地铁10号线	山体硬岩，花岗岩硬度90 Mpa以上，最大线路纵坡为36‰，最小纵坡为2‰。三三工业采用土压平衡盾构机代替硬岩TBM施工，创造了最快掘进记录，是其他国外品牌盾构机施工效率的两倍。
7	2016	兰州地铁隧道工程	地质条件为黄河边，高富水，低胶结性卵漂石地层，最大卵石粒径达2米。三三工业盾构机创造了20天连续日掘进20环，不卡机、不停机、不死机，是其他厂家的10倍效率，创造了兰州地铁施工记录。
8	2016	武汉地铁8号线	地质条件为黏土、强风化岩的复杂地层。面对地质条件极其复杂，对刀具产生加速磨损，三三工业两台直径6.48米复合式盾构机克服重重困难，提前3个月实现两条隧道的顺利贯通。
9	2017	北京轨道交通新机场线	地质条件为卵石圆砾、黏土、粉细砂、粉质黏土、细中砂。外径9114mm土压平衡盾构机，设计优良、性能卓越，最高日掘进20环32米，最高月掘进420环672米，受到业主及施工单位的高度认可。
10	2017	上海地铁18号线	地质条件为粉质黏土。开挖直径6790mm，三三工业盾构机克服地表沉降的风险，以卓越的品质保障全程掘进安全。
11	2017	成都地铁6号线	地质条件为超过70%为复合地层。掘进难度大、易超挖引起塌陷，最大纵坡为28.5‰，最终取得所有风险源累计沉降不超过3mm/成型管片几乎无破损和渗漏的优质工程，提前完成了洞通节点。
12	2017	福州地铁6号线	地质条件主要为淤泥、淤泥质土及粉质黏土，沿途下穿蓬洲港河、203省道、多座危桥及危房，施工要求及风险极高。实际掘进84天，最高掘进记录为16环/天。
13	2018	石家庄地铁1号线	地质条件为软土地层。全程978环、1173.82米，掘进穿越透水性强的砂层，砂砾地层，8月8日始发，11月10日贯通，历时仅94天。
14	2018	沈阳市综合地下管廊南运河段	地质条件为卵石圆砾、砾砂、中粗砂等地层。掘进穿越老城区且掘进跨越较长，三三工业设计的两台大功率、大扭矩、高速度盾构机最终超预期顺利的完成了掘进任务。
15	2019	杭州地铁5号线	地质条件为软土、杂碎石与圆砾地质，盾构机突遇孤石，直接破岩，为5号线掘取完工争取了富贵时间。

Overseas TBM Projects Reference
国外TBM业绩

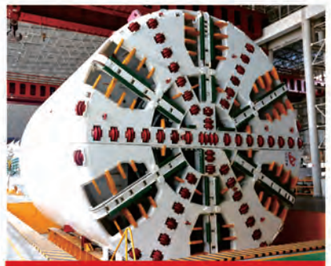
美国光明水工程

土耳其机场工程

美国Blacksnake河雨分流改造项目

俄罗斯莫斯科地铁工程

土耳其伊斯坦布尔污水隧道工程


中东地区引水隧道工程二期

美国西雅图光明水工程

意大利瑞士公路隧道工程

俄罗斯铁路隧道工程

伊斯坦布尔地铁工程

西班牙马德里地铁工程

美国华盛顿地铁工程

澳大利亚悉尼电缆隧道工程TBM

意大利-瑞士公路服务隧道TBM

美国华盛顿地铁工程TBM

Other Overseas TBM Projects Reference
其它国外业绩

序号 NO.	项目名称 Project Name	业绩描述 Performance Description
1	土耳其伊斯坦布尔污水隧道工程	代表我国首台出口海外的小直径土压平衡盾构机，创造土耳其伊斯坦布尔污水隧道工程掘进最高日进尺24环（31.2米）的土耳其最高掘进纪录。
2	俄罗斯莫斯科电缆工程	TBM-土压双模掘进机贯通隧道，破俄罗斯电缆工程掘进记录.
3	美国Blacksnake河雨分流改造项目	全球最小直径双护盾双模式TBM，可实现土压和硬岩双模式切换，适应更为复杂地层，为世界首例。
4	美国西雅图光明水工程	世界首台适用于7.3BAR高水压地层的土压平衡盾构机代替泥水平衡盾构机创记录。
5	意大利瑞士公路隧道工程	双护盾硬岩掘进机在埋深950米的阿尔卑斯山下连续掘进5.4公里，创造了月进尺493环、日进尺35米的纪录。
6	俄罗斯铁路隧道工程	在施工期间受到社区集会抗议停工5个月，但在设备性能出色发挥下，仍然在要求的工期内完成隧道施工。
7	俄罗斯莫斯科地铁工程	采用世界首台自上而下、30°陡坡掘进的超大直径盾构机，一举解决了阻碍工程施工的三大世界级难题。
8	伊斯坦布尔地铁工程	三三工业在土耳其伊斯坦布尔-缔造了一段穿越历史古建筑群的传奇。
9	伊朗大不里士引水隧道工程	我国首台出口海外的大直径土压平衡盾构打入中东市场。

Assets Acquisition of Caterpillar Tunneling Canada Corp.

跨国收购卡特彼勒加拿大隧道设备有限公司

2014年9月30日，在加拿大多伦多隆重举行了辽宁三三工业有限公司（三三工业）收购卡特彼勒加拿大隧道设备有限公司（CTCC)交割仪式。加拿大安大略省公民移民及国际贸易部部长陈国治、安大略省工业部祁放、中国驻多伦多总领事馆总领事房利、中国银行加拿大分行行长王立军、辽阳市人民政府副市长吕有宏、卡特彼勒加拿大隧道设备有限公司（CTCC)总裁Paul Clark、三三工业董事长刘远征、同行业及媒体代表共100多人出席了交割仪式。

CTCC是世界500强企业美国卡特彼勒的全资子公司，是国际隧道施工领域公认的高科技、数字化施工技术的领导者，其盾构机产品（TBM)被广泛应用到世界各地的地铁、市政、交通、水利、能源、海底隧道等施工项目中，获得奖项及赞誉无数。

此次收购，三三工业获得了CTCC的全部资产、知识产权、国际营销渠道，建立了自己的海外研发中心、制造中心、销售和售后服务中心。

三三工业已实现了TBM关键核心部件的国产化，实现了TBM的标准化、模块化生产，达到年生产100台的能力，正在建设全球最大、最先进的的盾构机/TBM隧道掘进机生产制造基地，以全球最先进的盾构机技术、最富有竞争性的条款向全世界新老客户继续提供久负盛名并广受信赖的产品和服务。

On Sept. 30, 2014, the Assets Closing ceremony was held in Toronto between LNSS and Caterpillar Tunneling Canada Corp. Present at the ceremony there were Hon Michael Chan, Minister of Citizenship, Immigration and International Trade of Ontario Government, Mr. Fang Li, Chinese Consul General in Toronto, Mr. Wang Lijun, Director of Bank of China Canada, Mr. Lv Youhong, Deputy Mayor of Liaoyang, Mr. Paul Clark, President of CTCC and Mr. Liu Yuanzheng, LNSS Chairman.

CTCC is a subsidiary of Caterpillar Inc.. It was regarded as the leader in the TBM industry. It TBM products have been widely used in the metro, sewer, traffic, hydropower, energy and cross-sea tunnel projects.

Through the acquisition, LNSS has obtained all Assets of CTCC, including plant, equipment entire Intellectual Properties and global sales network.

LNSS has realized localization of key TBM components manufacturing, and standardized and modular production. We aim at reaching annual production volume of 100 TBM units and becoming the largest, most advanced leading TBM manufacturer in the world.

Lovsuns Tunneling Canada Ltd.

勒沃森加拿大隧道设备有限责任公司概况

Lovsuns Tunneling Canada Ltd. (Lovsuns) is a wholly owned subsidiary of LNSS based in Toronto, Canada. It is the overseas engineering, manufacturing, sales and service centers of LNSS. Its Toronto facilities cover a land area of 15,000 m2, possess world class equipment, its annual capacity can reach 20 TBM units.

CTCC was formerly known as Lovat. Lovat was founded in 1972, it was recognized as the leader in the soft and mixed ground mechanized tunneling technology. Over the past 40+ years, Lovat TBMs mined more than 2500km of tunnels around the world and have gained its reputation for the outstanding quality and durability.

The key ex-Lovat engineering, production and management employees have now joined Lovsuns. With their profound experience and know-how, Lovsuns can maintain the leading position in TBM design, engineering and manufacturing. Moreover, Lovsuns can continue to develop new products according to the market needs.

Lovsuns has established its sales network in Asia-Pacific, Europe, North America and South America markets, and realized the first international sales in Turkey. Lovsuns will continue expanding its global sales/service network and promote LNSS branded products.

勒沃森加拿大隧道设备有限公司是辽宁三三工业有限公司收购美国卡特彼勒加拿大隧道设备有限公司全部资产和知识产权后，以自己的品牌在加拿大重新更名注册的全资子公司，总部位于多伦多市，是三三工业在海外的研发中心、生产制造中心、销售和售后服务中心。勒沃森多伦多主厂区占地约15000平方米，装备有世界一流的加工制造设备，年生产能力达到20余台。

作为全球拓展战略的关键一环，三三工业于2014年1月与美国卡特彼勒加拿大隧道设备有限公司（CTCC)签订了资产收购协议。按此协议，三三工业全面收购了CTCC包括土地、厂房、设备和全套知识产权在内的所有资产。CTCC的前身是加拿大LOVAT公司。LOVAT公司成立于1972年，是国际上公认的软土和复合地层隧道掘进机（TBM）生产商，在40多年的发展历程中，LOVAT品牌的TBM被广泛应用于世界各地的市政、交通、城市地铁、跨海隧道、油气管线等隧道工程，其精湛的设计和制造工艺以及经久耐用的品质赢得了业内的高度赞誉。

勒沃森公司现有员工绝大部分都是原LOVAT的核心工程设计、生产制造和管理人员。凭借所收购的全套知识产权和这些核心员工数十年的专业经验，勒沃森公司将继续传承并保持在TBM设计研发和生产制造方面的国际领先水平，同时根据市场和客户的需求，持续研发更为先进的TBM产品。

成立至今，勒沃森公司已在亚太、欧洲、北美和南美地区建立了自己的销售网络，并在土耳其成功销售了海外第一台TBM，正式跨入国际市场。勒沃森公司将按照三三工业全球化的战略，不断扩建销售和服务网络，打造具有国际影响力的三三工业品牌。

Featured CCP Building
特色党建

不忘初心 牢记使命

2015,经上级组织部门批准，三三工业正式成立了党委。目前，公司党委设有9个党支部，党员107人、入党积极分子近100人。党建活动始终贯穿科研、生产、经营、管理的全过程。多年来，三三工业在上级党组织的高度重视和引导下，不断强化党建意识，营造党建氛围，打造党建品牌，形成了别具特色的“三三”党建格局，“三培养”保证了党的质量，“三注重”营造了党建氛围，“三带动”发挥了党员作用。

In 2015, CPC Committee of Liaoning Censcience Industry Co., Ltd was established after approval by superior organization. Nowadays, there are 9 CPC branches in LNSS CPC Committee with 107 approved Party members and 100 probationary party members. The Party building activities are continuously going through entire process of R&D, manufacture, business running, and company management. Over the years, under the high attention and supervision from superior organization, LNSS is continuously strengthening Party building consciousness, creating Party building environment, building Party building brand, and gradually established LNSS special Party building pattern. “Three Talent Cultivation” guarantees Party Quality; “Three Emphasis” creates Party building atmosphere; “Triple Three” makes Party Member play an important role.

Corporate Culture
企业文化

ENTERPRISE MOTTO **企业口号**

品质创造未来
Quality Creates Future

ENTERPRISE CONCEPT **企业理念**

专注核心产品 引领技术进步
Focusing on core products, leading the technological advance

ENTERPRISE MISSION **企业使命**

发展企业 幸福员工 贡献社会
Develop the enterprise, Bring welfare to employees and make social contributions

ENTERPRISE SPIRIT **企业精神**

创造无止境 服务至真诚
Constant Innovation and Unmatched Services