1415 East Elwood Street, Phoenix, Arizona 85040 USA
PO Box 10490, Casa Grande, Arizona 85130 USA

(602)268-9275 - (520)836-7869

GOMEZ INTERNATIONAL, INC.

Company Profile

Gomez International Inc., formally Gomez Tunneling Systems International, was started in 1991 and incorporated in 2005. Our staff has over 67 years of combined experience in the tunneling, construction, and mining industries. Specializing in heavy civil, bridge, power, mining and tunneling projects and equipment manufacturing, rebuild and supply, Gomez International is positioned to support your project in all aspects, whether it is a large public infrastructure or a small private project. Our Clients include owners, contractors, engineers, consultants, manufacturers and suppliers. Providing consulting, estimating, project field support, engineering, design, equipment manufacturing, equipment rebuild and equipment and material supply. Gomez International Inc. strives for success through advanced management development. By interfacing and integrating with all participants, and implementing high Quality Control/Quality Assurance (QC/QA) standards, a proactive and reactive company, quick to develop situation response teams as needed. From design and development to onsite installation, Gomez International Inc. surpasses project expectations with enhanced customer support.

Gomez International, Inc. has two locations. Our Manufacturing and Rebuild division, Procurement Specialists, is ideally located in the Arizona dry desert at 1415 E Elwood Street, Phoenix, Arizona 85040. The shop facility has over 20,000 square feet under one roof, with on and off site equipment storage totaling over 30 acres. Fully staffed with heavy equipment mechanics, welders, metal workers, painters, electricians and machinists. Our manufacturing/rebuild facility includes all of the necessary production equipment and engineering, fabrication and administration needed to provide our customers with the needed equipment and supplies they require. We strive to provide quality equipment and services to aid in our clients' successful completion of their projects. From complete diesel engine and equipment re-builds, to high voltage switch gear, mine power transformers, high voltage cable assemblies, ventilation fans, equipment/workshop connex's, tunnel excavators, conveyor systems, tunnel seals, peristaltic and submersible pumps, grout and bentonite mixing plants, to rolling stock i.e. tunnel locomotives, man cars, lift off muck boxes, segment handlers, etc., we can supply, manufacturer, build and/or remanufacturer nearly anything our customers request. As the North, Central and South American Sales and Service Representative for several innovative manufacturers we are able to provide quality products to meet any requirement. Our main administrative offices are located at 9075 Hazeldine Road/PO Box 10490, Casa Grande, Arizona 85130.

GOMEZ INTERNATIONAL, INC.

AREAS OF EXPERTISE:

- Types of Tunnel Boring Machines we provide services for:
  - Hard Rock Tunnel Boring Machines
  - Slurry Shield Tunnel Boring Applications
  - Soft Ground Earth Pressure Balance (EPB) Applications
  - Single Shield Tunnel Boring Machines
  - Double Shield Tunnel Boring Machines
  - Directional Drills and Drilling Applications
  - Road Headers
  - Raise/Down Reaming/Box Hole, and Combination Boring Machines
  - Micro-tunneling/Pipe Jacking Applications
- Back-up/Trailing Floor and Auxiliary Support Systems
- Conventional Mining Applications
- Communications Systems
- Conveyor Haulage
- De-watering Systems
- Electrical Instrumentation and Control Systems Including PLC's
- Low, Medium, and High Voltage Electrical Distribution up to 69KV
- Rock Support Methods
- Rolling Stock
- Segment Lining Systems
- Ventilation Systems
- Data Collection Systems
- Engineer/Design/Build Custom Components and Systems including Tunnel Segments
- Equipment procurement, manufacturing, rebuild

SERVICES INCLUDE:

Gomez International Inc. provides numerous services in the Mining, Tunneling and Construction Industries. The following is an abbreviated list of some of the services we currently provide. Depending upon the projects requirements and our clients' needs, we strive to accept any challenge and achieve success. The services we provide are not limited to those listed below and include all aspects of mining, tunneling and construction industries.

- Constructability Review
- Contractual Issues
- Cost Estimating
- Data Collection and Instrumentation
- Design and Manufacturing Audits
- Engineer/Design/Build Tunnel Segments to Owners Specs.
- Electrical System Design, procurement, supplier, equipment manufacturer and coordinate installation and training.
- Dispute Review Analysis, Forensics and Resolution
- Manufacturing – Electrical, structural (conveyor systems), utility supports etc
- Equipment rebuild/refurbishment to meet project requirements
- Equipment lease - including but not limited to tunnel locomotives, ventilations fans, conveyor systems, tunnel excavators
- Job-site Support
- Manufacture Design Guidelines
- Performance Estimates
- Preventive Maintenance Program
- Project Management
- Project Scheduling
- Risk Analysis, Identification and Evaluation
- Site Investigation
- Startup Engineering
- Supplier Quality Control and Quality Assurance Audits
- TBM Feasibility Studies
- Utilization Analysis and Recommendations

GOMEZ INTERNATIONAL OFFERS SOLUTIONS FOR:

- Improved Tunnel Boring Machine and Related Equipment Performance
- Low Tunnel Boring Machine and Related Equipment Production Rates
- Low Tunnel Boring Machine and Related Equipment Utilization
- Site Assembly and Assembly Delays
- Major Tunnel Boring Machine and Related Equipment Break-downs
- Unacceptable Manufacturing Quality
- Unexpected Geological Delays
- Tunnel Boring Machine and Equipment Modifications
- Excessive Consumable Costs
- Owner/Contractor/Supplier Disputes Resolution
- Improving Personnel Expertise and Training
- Equipment/Systems Redesign to meet projects unique requirements.

CLIENTS:

Gomez International Inc. has participated in projects throughout the World. Our list of clients includes Tunneling Contractors, Project Owners, Designers, Specialty Contractors, Arbitrators, Associated Consultants, Municipalities, Federal and State Agencies, Tunnel Boring Machine Manufactures, Legal Firms, Equipment Suppliers, and Related Vendors.

United States and Canada

- Anderson Electric Controls
- Atkinson Construction
- Affholder Construction
- B&W Controls
- Barnard Construction Co.
- Broken hills Properties (BHP)/Magma Copper Co.
- CSR New England Pipe
- Colorado School of Mines
- DMJM-Daniel, Mann, Johnson & Mendenhall
- Frank Coluccio Construction
- Frontier Kemper Constructors
- Jay Dee Construction
- Jenny Engineering
- Johnson Brothers Construction
- Harrison Western Corporation
- Hatch, Mott, MacDonald
- Hitachi Zosen - USA
- ILF Consultants
- Impregilo
- Laborers International Union North America
- Kanadan
- McNally International
- Metropolitan Water District of Southern California
- Michels Corporation
- Nancy Creek Tunnel Constructors
- New York, Department of Environmental Protection
- Nova Group Inc.
- Obayashi Corporation USA
- Oles, Morrison, Rinker and Baker
- Ortiz Corporation
- S.A. Healy Company
- Snyder Engineering
- Shimmick Construction
- Skanska Construction Co.
- Southland Contracting
- Stacy & Witbeck Inc.
- Stillwater Mining Co.
- Trumbull Corporation
- University of Arizona-Mining Safety Program
- UTILIX Corporation
- W.W. Clyde Brothers Construction

Germany

- Dielmann Haniel
- Herrenknecht AG
- ILF Consultants
- Soltau Microtunneling
- Zublin Contracting

France

- Campenon Bernard SGE
- Spie Batignolles

Japan

- Hitachi-Zosen-Japan
- Obayashi Corporation Tokyo

United Kingdom

- Balfour Beatty

South Africa

- LTA Contractors
- LHPC (Lesotho Highlands Project Contractors

Mexico

- Cotrisa/Constructora Andrade Gutierrez, S.A. de C.V.

EXPERIENCE

Our employees have served as Engineer, Operations Manager, Project Manager, Tunnel Boring Machine Operations Manager, Projects Field Manager, Project Engineer, Field Engineer, Design Engineer, Superintendent, Start-up/ Commissioning Engineer, Equipment Operations Manager, Field Supervisor, Expert Witness, Consultant, and in whole or part as the general superintendent, tunnel superintendent, equipment superintendent, mechanical superintendent and electrical superintendent.

The following is a brief summary of various major projects and positions our employees have held:

Project Engineer/Consultant for:

Obayashi-led JV, Eglinton Subway Tunnel Project;
Magma Copper Lower Kalamazoo Tunneling Project, San Manuel, Arizona;
Nova Group Inc., Kailua Kona, Hawaii;
Metropolitan Water District of Southern California, San Bernardino Aqueduct, San Bernardino, A
Stillwater Mining Company, East Boulder Project, Big Timber, Montana;
Obayashi / Kanadian J.V., Sir Adam Beck Hydro Electric Tunneling Project, Ontario, Canada;
Ortiz Corporation, Home Avenue Sewer II, San Diego, California;
Obayashi / W.W. Clyde J.V., Upper Diamond Fork Tunnel, Spanish Fork, Utah;
Obayashi / Johnson Bros. J.V., Minneapolis Light Rail Tunnel & Station;
Nancy Creek Constructers, Nancy Creek Tunnel Project;
Obayashi/MASSANNA JV, West Area CSO Tunnels and Pump Station;
Eastside LRT Constructors, Los Angles Gold Line Extension, Light Rail Tunnels and Stations;

Consultant/Engineer/Design/Build for

Hitachi Zosen, Alaskan Way Viaduct & Seawall Replacement Program SR99;
Southland Contractors, N. McGregor Shafts, Tunnel and Tunnel Segment-Engineer/Design/Build;
Beacon Hill Tunnels and Stations, Obayashi Corp;
Colorado River Bridge (Hoover Dam Bypass), Obayashi PSM JV;
North Connector Tunnels and Station, North Shore Constructors JV;
Stacey & Whitbeck

Project Consultant for

Lesotho Highlands Project in the Kingdom of Lesotho, Africa;
Cotrisa-AG, Mexico City, Mexico;
Hitachi Zosen, SR99, Seattle, Washington;
Jay Dee Contractors-Frank Coluccio Construction-Michels Corporation JV, Seattle, WA;
Michels Corporation-Jay Dee Contractors-Frank Coluccio Construction JV, Menlo Park, CA;

Equipment Supplier for

Barnard/Impregilo/Healy JV
Electrical Automation Specialists
Intermountain Electronics
Hitachi Zosen
Jay Dee/Coluccio Construction/Michels Contracting, U230, Seattle, Washington
Kraemer/Obayashi JV
McNally Construction
Michels/Jay Dee Construction/Coluccio Construction, San Francisco Bay Tunnel Project
Obayashi Corporation
Shimmick
Trumbull Corporation
US Electric Corporation
Vegas Tunnel Constructors
W.W. Clyde & Company

EXAMPLES OF SOME OF THE EQUIPMENT WE HAVE TO OFFER FOR SALE OR LEASE

Liebherr R932T Tunnel Excavators - Fully Reconditioned

Brookville 30, 24, 20 and 15 Ton Locomotives & Rolling Stock - Completely Rebuilt

Maxi-Power Centers

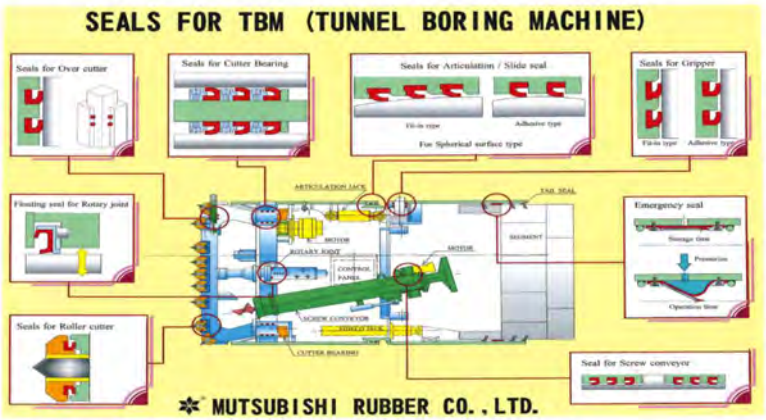
Hogg-Davis Reeler

Skid-Mounted Switchgear

15kV Transformer

MANUFACTURER REPRESENTATIVE

In addition to offering support to our clients, in all aspects of the construction process, we are also able to provide specialized equipment through partnering with Manufacturers as their Sales and Service representative in North, Central and South American. These Manufacturers offer customized equipment and material to aide in the successful completion of a project. From Entrance and Exit Seals, Tunnel Boring Machines, Grout Plants, Tunnel Locomotives, and more. We offer help and assistance in Engineering and Design to serving as lesion with the Manufactures to help our customers receive the most effective equipment to meet their needs.



Mutsubishi Rubber
Entrance seal system (Launch and Exit), Flex rubber Seal at tunnel portal structure, Rail pad for vibration and noise prevention, Seals for TBMs and disc cutters. Plant, Shell bit

Sagami-Servo
Grout Plants
Peristaltic Pumps
Slurry Plants
Foam Injection Systems
Batch Plants

Shin-Tomoe Electrical Manufacturing Co. *Battery Locomotives, Custom Battery Powered Carrier*

FOR ADDITIONAL INFORMATION AND COMPLETE LIST OF EQUIPMENT OFFERED PLEASE SEE MANUFACTURER'S BROCHURES

1415 East Elwood Street, Phoenix, Arizona USA 85040 (602)268-9275
PO Box 10490 Casa Grande, Arizona USA 85130 (520)836-7869

KEY EXECUTIVES

Renetta Gomez - President/Chief Executive Officer

Years of Experience - 30
Education - Degree in Business Management, New Mexico State University, 1980
Summary of Qualifications
Comprehensive background in all aspects of business management, human resources management, employee benefits, accounting and financing.

Professional Positions
President/CEO
Owner - Gomez International, Inc. (formally Gomez Tunneling Systems International) since 1991
Owner - Retail store since 1993 to present
Assistant - Personnel Manager
Benefits Administrator

Frederick (Rick) P Gomez - Vice-President/Chief Operations Officer

Years of Experience - 40
Summary of Qualifications
Comprehensive background in all aspects of electrical, mechanical, civil and underground construction applications, including mechanized-tunnel boring, micro-tunneling, directional drilling, raise boring, rock support systems and methods, conventional underground excavation methods and procedures, concrete, grouting and shotcrete placement methods and procedures, hydroelectric generation, pumping stations, waste water treatment facilities, oil and natural gas refineries, coal fired generation facilities, nuclear device assembly facilities, acid plants, SO/2 removal systems, and fly ash recovery systems (bag-houses and precipitators).

Extensive knowledge of employee, customer and management relations, construction management organization, and training methods.

Professional Positions
Vice-President/COO
Consultant
Owner - Gomez International, Inc. (formally Gomez Tunneling Systems International) since 1991
Project Engineer
Project Field Manager
Project Manager/Superintendent
Start-up Engineer/Technician

James J Gomez - Vice-President of Operations

Years of Experience - 15
Summary of Qualifications
Manager of our Manufacturing/Rebuild Division, Procurement Specialists. Responsible for all equipment manufacturing and rebuild scheduling, equipment design, man-power allocation, budgeting, material procurement and safety. Supervises two teams of employees in all aspects of manufacturing, from design, through fabrication, to final inspection. Comprehensive background in electrical, mechanical and metal fabrication. Some of the manufacturing/rebuild projects successfully overseen are: the manufacturer and/or rebuild, repair and

testing of both low and high voltage switchgear, transformers, mobile sub-stations, 15kV power cable assemblies, hydraulic cylinders and systems, pumps, ventilations systems, compressors and more. In charge of complete equipment tear down and rebuilds, including Liebherr 932 Tunnel Excavators, Brookville 30, 24 and 20-ton diesel powered locomotives, Caterpillar 80,000lb forklift and Duetz V-10 diesel engine rebuilds, and many more projects too numerous to list.

Professional Positions
Vice-President of Operations
Operations Manager
Project Supervisor
Project Manager
Field Supervisor

Asao Nomura - Vice-President of Engineering

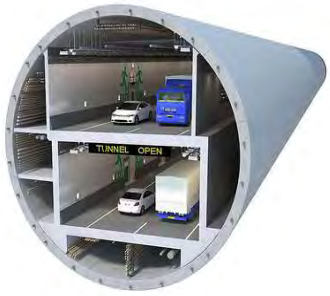
Years of Experience - 37
Education - B.Sc., Mechanical Engineering, Yamanishi University, 1980
Summary of Qualifications
Supervised the design, procurement, start-up and operation of a variety of typical and specialized equipment on many large, complex heavy construction projects. This equipment has included many pressurized face tunneling machines such as EPB and slurry shield machines. Four of these machines had personnel airlocks to allow hyperbaric interventions. Supervising the procurement, start-up and operation of the 14.14m (46.4') slurry shield machine used on the Trans-Tokyo Bay Highway Tunnel. Designed and implemented a variety of equipment applications specifically for controlled excavation in soft or difficult ground conditions. Recent 17 years' experience in soft ground tunneling; prior to that involved in the engineering and construction of heavy structural and earth retaining walls. Supervised equipment design, production and delivery, on-site installation, training and start-up, and daily equipment operations. Responsible for oversight of preventative maintenance and major repairs and overhauls performed by project field personnel. In addition, responsible for the on-site, training, development, and implementation of TBM hard rock, earth pressure balance and slurry, operating and excavation procedures, including but not limited to soil conditioning, grout injection, and tool replacement. Training also included the development of operational contingencies such as the inability to form plug in screw, unable to advance the TBM, Settlement mitigation procedures, unable to control muck discharge from the screw, and damage to segments.

Professional Positions
Vice-President of Engineering
Engineering Manager
Project Engineer
Tunnel Operation Engineer
Project Manager
Equipment Operations Manager
Project Engineer-Mechanical/Electrical
Field Mechanical Engineer
Equipment Manager

MAJOR PROJECTS

January 2010 - Present

PROJECT:	Alaskan Way Viaduct & Seawall Replacement Program, SR99 Bored Tunnel Alternative Design-Build Project.($1,018,123,002.00)
POSITION:	Consultant/Engineer
CUSTOMER:	Hitachi Zosen
FOR:	City of Seattle, Washington




The project is utilizing the world's largest Tunnel Boring Machine 57.5-ft diameter. Manufactured Hitachi Zosen, this Earth Pressure Balance Machine will bore 2.7 miles of double-decker high way tunnel.

June 2012 - Present

PROJECT:	Eglington Subway Tunnel Project
POSITION:	Technical Advisor/Consultant
CUSTOMER:	Obayashi-led JV

February 2010 - Present

PROJECT:	San Francisco Water Department – Contract WD2531 Bay Division Pipelines Reliability Upgrade Bay Division Pipeline No.5 – Bay Tunnel - ($215,294,530.00)
POSITION:	TBM Operations / Plant & Electrical Manager - Design Engineer / Estimator / Consultant
CUSTOMER:	Michels / Jay Dee / Coluccio JV
FOR:	San Francisco Public Utilities commission City and County of San Francisco

The project utilized a Hitachi Zosen Earth Pressure Balance Tunnel Boring Machine to bore the water conveyance tunnel through soft ground under the San Francisco Bay. A 58 ft. diameter x 141 ft. deep launch shaft was excavated under water inside concrete diaphragm walls. A concrete plug was placed under 130 ft. of water. The retrieval shaft, 23 ft. diameter x 98 ft. deep was constructed using frozen walls with temporary ring beams and lagging support. There were no intermediate shafts in the 26,280 ft. in tunnel length. The tunnel utilized a two-pass lining system incorporating, bolted and gasketed, precast concrete segments 14-ft 10-in O.D. x 12-ft 10-in I.D., 5 ft. in length, for the initial tunnel support and a welded 9-ft diameter steel pipe, cement mortar lined, grouted in place for the final water carrier pipe. Included were various pipe connections at the surface along with control valves and site restoration.


WD2531 Bay Tunnel – 115kV Substation
Equipment Supplied by Procurement Specialists
a division of Gomez International, Inc.

January 2010 - May 2012

PROJECT:	Brightwater Project, Seattle, Washington
POSITION:	Consultant/Engineer.

July 2009 - Present

PROJECT:	U-230 Capitol Hill Station to Pine Street Stub Tunnel - ($154,139,000)
POSITION:	TBM Operations Manager / Design Engineer / Estimator
CUSTOMER:	JCM-U Link JV
FOR:	Sound Transit Seattle WA

Project included construction of two 3,800ft 21-ft 6-in O.D. x 18-ft I.D. segmental lined twin running tunnels between Capitol Hill Station and the Pine Street Stub Tunnel (PSST); excavation and initial support of the Capital Hill Station; five SEM (sequential excavation method) cross-passages at intervals between pressurized face TBM bored tunnels; and construction of a temporary TBM retrieval shaft at the PSST headwall and completion of the tunnel interfaces with the PSST. Hitachi Zosen Earth Pressure Balance tunnel boring machine with continuous conveyor system.

July 2008 - Present

PROJECT:	Golden Gate Bridge Retrofit Phase IIIA, North Anchorage Housing, & North Pylon Seismic Retrofit ($125,000,000)
POSITION:	Consultant / Designer
CUSTOMER:	Shimmick / Obayashi, a Joint Venture
FOR:	CalTrans, Sausalito, CA

The seismic retrofit measures for this project consist of strengthening foundations, installation of micro piles and rock bolts, construction of reinforced concrete shear walls, replacement of the housing roof/roadway deck with a pre-cast concrete slab-on-steel stringer deck system involving nighttime lane closures, and other structural modifications

February 2007 - September 2008

PROJECT:	P-998 Power Upgrades, USS Ronald Regan Berth
POSITION:	Consultant / Designer
CUSTOMER:	Obayashi Corp. Tokyo, Japan
FOR:	United States Army Corp of Engineers, Yokosuka Naval Station

Design and construction contract included a new operational Medium Voltage electrical distribution system, extension to interconnect the existing 13.2 KV e-bus and 60 Hz distribution switchgear in Building 1805 to the two new 13.2 MV feeders from the new cogeneration facility with new switchgear, and to provide three new 13.2 KV looped feeders from the new switchgear to Substations A, B, and C with single feed from substation C to substation D at Yokosuka Naval Base, Japan, to support the ships that will be docked at berths 11.5, 12 and 13. In order to provide adequate reactive power support for the start-up of the large motors on the ships, a 15 MVA synchronous condenser and a 4.5 MVA frequency converter were also provided in new structures with supporting switchgear. The scope of work also included review of the 13.2kV short circuit coordination study and integration of with existing SCADA and existing condensers and frequency converters.

November 2005 - March 2006

PROJECT:	ECRB TBM Inspection, Yucca Mountain Project
POSITION:	Consultant / Expert
CUSTOMER:	Colorado School of Mines
FOR:	Bechtel SAIC Company Yucca Mountain Project Nevada Test Site NV

Task Order #6 was prompted after DOE scientists determined that all equipment in the ECRB should be removed. The tunneling equipment inspected consisted of a complete TBM System: A modified Robbins 166-245 TBM, a six-car-plus-ramp single track trailing unit approximately 200 ft long.

June 2005 – April 2010

PROJECT:	North Shore Connector Tunnels and Station Shell ($156,500,000)
POSITION:	Project Field Manager/TBM Operations Manager/Consultant/ Designer
CUSTOMER:	North Shore Constructors JV (Obayashi Corporation-led)
FOR:	Port Authority of Allegheny County, Pittsburgh PA

Project consisted of twin light rail 2,240-lf segment lined tunnels 21-ft, 10-in. diameter in addition to a cut-and-cover station and supporting structures. The Alleghany under-river portions of the tunnels are approximately 867 ft each way with the remainder of the alignment passing below the business district. The tunnel passes roughly 21-ft below the river bed and through fluvioglacial and alluvial deposits. To bore the tunnels, a Herrenknecht slurry pressure balance mix shield TBM was selected along with modified Herrenknecht supplied slurry separation plant.

September 2004 - 2010

PROJECT:	US93 / Hoover Dam Bypass, Colorado River Bridge ($114,000,000)
POSITION:	Project Engineer / Superintendent / Designer / Consultant
CUSTOMER:	Obayashi Corp/PS Mitsubishi JV
FOR:	US Department of Transportation Federal Highway Administration Hoover Dam AZ/NV Border

Project consisted of a Steel-Concrete Composite Arch Bridge spanning the Black Canyon Gorge, 1600-ft south of Hoover Dam, connecting the Arizona and Nevada approach highways, with four lanes 1,896-ft long, width of 88-ft, 1,060-ft twin-rib cast in place concrete arch, rise of 277-ft. With 15 pier footing with a maximum height of 287-ft (at P4, P15). The bridge deck is nearly 900-feet above the Colorado River.

April 2004 - 2011

PROJECT:	C710 Beacon Hill Tunnels and Stations – ($279,000,000)
POSITION:	Project Field Manager/Start-Up Coordinator/Superintendent/ Consultant
CUSTOMER:	Obayashi Corp.
FOR:	Sound Transit, Seattle WA

Contract includes construction of two 4,400ft x 18-ft I.D. segment lined twin running tunnels. The contract included construction of one mile tunnel under Beacon Hill, the west and east portals, a half mile of elevated trackway, and

the Beacon Hill and Mount Baker stations. The main shaft of the tunnel station holds the station's four high-speed elevators, and the secondary shaft which provides ventilation and emergency staircases excavated to 165 feet deep. Mining methods included digging the northbound and southbound running tunnels (by use of the tunnel boring machine), all of the station's cross-passages (+/- 2000-lf) (3) and ventilation and the underground station concourse, using Alpine road header in conjunction with the sequential excavation technique. A 21'/6" Mitsubishi Heavy Industries, Earth Pressure Balance tunnel boring machine excavated with a continuous conveyor system.

Beacon Hill Tunnel and Stations

April 2004 - July 2007

PROJECT:	West Area CSO Tunnels and Pump Station ($243,288,000)
POSITION:	Project Engineer / Designer / Consultant
CUSTOMER:	Atlanta CSO Constructors
FOR:	City of Atlanta Department of Watershed Management, Atlanta GA

Project consisted of multiple shafts, and wastewater tunnels bored 27-ft in diameter, approximately 43,700-lf in length, and concrete lined intermittently to a finished diameter of 24-ft. The North Avenue tunnel runs 4.5 miles from the R.M. Clayton Water Reclamation Facility to the North Avenue CSO facility. The Clear Creek tunnel starts at the Rockdale shaft, located near the mid-point of the North Avenue tunnel, and runs 3.9 miles to the Clear Creek CSO facility. Two Herrenknecht hard rock main beam tunnel boring machines with continuous conveyor system.

March 2004-July 2009

PROJECT:	Metro Eastside Extension Light Rail Tunnels and Stations (Gold Line) ($640,000,000)
POSITION:	Project Engineer / Designer / Consultant
CUSTOMER:	Eastside LRT Constructors
FOR:	LA METRO Los Angeles CA

Project includes 1.7 miles 21-ft bored twin 18-ft I.D. segment lined tunnels, bored with two Herrenknecht EPB tunnel boring machines. Included were two underground stations Boyle and Soto, along with East Portal and West Portal stations. In addition to the construction of five miles of at-grade rail work, totaling 6-miles of track an extension of the Pasadena Gold Line, which runs 13.7 miles from Pasadena to Union Station in downtown Los Angeles.

May 2004-October 2006

PROJECT:	Affholder / Elmore Pipe Jacking, Deficient Lovat EPB Tunnel Boring Machine Issue - Las Posas Feeder No. 3 Unit 2
POSITION:	Consultant / Expert
CUSTOMER:	Callegaus Municipal Water District, Thousand Oaks, CA
FOR:	Callegaus Municipal Water District, Thousand Oaks, CA

The project consisted of number of 90-in jacked steel casing crossing including the Arroyo Simi where the Lovat TBM supplied by Affholder/Elmore was became entrapped requiring its subsequent rescue. The contractor elected not to operate in EPB mode, instead the EPB was assembled and installed to operate in the open mode, without the aid of the screw conveyor, and ability to inject conditioning agents as specified by LOVAT, the TBM became entrapped by the compaction of gravel, sands, and silts between the loading plates, and direct result the cutterhead could not rotate and muck could not be discharged through the muck ring located at the 12:00 position, therefore requiring its rescue

2009-Present

PROJECT:	Big Sandwash Dam ($31,400,000)
POSITION:	Consultant / Designer
CUSTOMER:	Frank Coluccio Construction Co.
FOR:	Central Utah Water Conservancy District

Clay core construction of the dam, with a new outlet tunnel 1200-ft x 8-ftdiameter excavated by roadheader.

November 2003-January 2004

PROJECT:	Task Order No.3 Power System and Distribution Study
POSITION:	Consultant / Expert
CUSTOMER:	Colorado School of Mines, Anderson Electric Controls
FOR:	Bechtel SAIC Company, Yucca Mountain Project Nevada Test Site NV

Co-authored detailed study including cost estimation, drawings, and means and methods to design the power distribution system required to support 6-tunnel boring machines and related support equipment operating simultaneously at the Yucca Mountain, Nuclear Repository.

December 2003-February 2007

PROJECT:	North MacGregor Storm Sewer Relief Tunnel ($11 million)
POSITION:	Project Engineer / Consultant / Designer
CUSTOMER:	Southland Contracting
FOR:	City of Houston, Houston TX

The project consisted of 7,340-foot by 13.5' diameter storm sewer in tunnel and is to be constructed using an approved one-pass precision cast concrete segmental lining tunneling method. The approved tunneling method required the utilization of a closed face tunneling machine (Earth Pressure Balance Machine) that will allow tunneling to proceed without active dewatering along the tunnel alignment from the ground surface. The six piece gasketed, and bolted, pre-cast concrete segmental lining will be installed simultaneously with the TBM's tail shield and will be grouted in place to establish positive ground support and maintain a pressure seal with the Earth Pressure Balance Machine.

Ground conditions along most of the tunnel alignment consisted of mixed face conditions with low plasticity, silty and sandy clay above the tunnel and in the upper portion of the tunnel face, and silty sand and sandy silt in the lower portion of the tunnel face and below the tunnel

Ground water levels within the underlying silty sand and sandy silt deposits are expected to be at or above the contact between this deposit and the overlying clay, and are dependent upon the season and recent precipitation levels.

July 2002-September 2002

PROJECT: Holme Ave. Tunnel Project
POSITION: Expert / Consultant
CUSTOMER: Ortiz Corp.
FOR: City of San Diego

Project consisted of the evaluation of a micro-tunnel boring machine's (MTBM) performance during the attempted boring of the Holme Ave. sewer pipeline replacement project. Report was submitted stating that geological baseline report was incorrect and that boulder half the size of the cutterhead could not be ingested into the stone crusher.

July 2002

PROJECT: TBM Electrical Distribution System Failure
POSITION: Expert / Consultant
CUSTOMER: Affholder Construction Co.
FOR: South Mountain Water Transmission Tunnel

The water transmission tunnel project consisted of approximately 6,332-lf of approximately 7-ft diameter tunnel.

March 2003-July 2004

PROJECT: Tanner Ridge Pipeline, Tunnel, and Structures
POSITION: Project Engineer / Consultant
CUSTOMER: Obayashi / W.W. Clyde Bros. J.V.
FOR: US Bureau of Reclamation

Project included the estimate for the re-bid of the Tanner Ridge Portion of the Upper Diamond Fork Tunnel Project, and the design and installation of 25kV transmission system within the new pressure tunnel.

March 2002- June 2006

PROJECT: Nancy Creek, Shafts, and Tunnels
POSITION: Project Engineer / Consultant
CUSTOMER: Nancy Creek Constructors
FOR: City of Atlanta, Georgia

Project consists of multiple shafts, and wastewater tunnels bored 18-ft in diameter, approximately 43,700-lf in length, and concrete lined to finished diameter of 16-ft. The Nancy Creek Tunnel is a deep tunnel, designed to store and convey wastewater by diverting flows from trunk sewers currently at or near capacity in the northwest of the City of Atlanta. Two 18-ft Robbins hard rock main beam tunnel boring machines with 24-in continuous conveyor system were utilized to excavate the tunnels

March 2002-June 2006

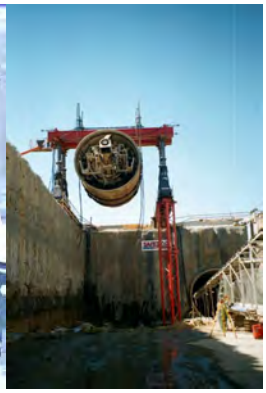
PROJECT:	Water Tunnel No.3 Manhattan Section
POSITION:	Project Engineer / Consultant
CUSTOMER:	Jenny Engineering Co.
FOR:	New York Department of Environmental Protection

Evaluate the Manhattan Tunnel Plans and Specifications, including inspection of cores and pertinent geological information prepared by DEP.

April 2001 – October 2004

PROJECT:	Minneapolis / St. Paul Light Rail Tunnels, and Station ($110,000,000)
POSITION:	TBM Operations Manager / Project Engineer / Project Field Manager / Superintendent / Consultant
CUSTOMER:	Obayashi / Johnson Bros. J.V.
FOR:	Minneapolis Airport Commission

Light rail tunnels and station project, consisted of twin 7,400-lf tunnels driven 20-lf apart, totaling approximately 14,800-lf of tunnel, 24-ft diameter, with segmental lining finished at approximately 18-ft diameter. Using a refurbished Herrenknecht combination EPB/Open TBM, boring through limestone, sandstone, boulder, and alluvium. Lining consists of a six-piece ring and one smaller keystone. Annular grout, of approximately six cubic yards, was injected behind each five-foot ring. Excavation of midpoint station, twin 600-ft multi bench method with Alpine Road Header.



March 2001-December 2003

PROJECT:	Queens Tunnel Dispute Resolution ($172,000,000)
POSITION:	Expert / Consultant
CUSTOMER:	Jenny Engineering Co.
FOR:	New York Department of Environmental Protection

Project included the evaluation of two requests for change submitted by the Joint Venture Contractors, Grow/Perini/Skanska, “Reduced Penetration” and “Disturbed Ground” The water tunnel project consisted of approximately 26,000-lf of 24-ft diameter tunnel excavated in granite and gneiss, with igneous intrusions. The Atlas Copco Robbins TBM 235-282 was utilized to bore these tunnels.

September 2001-October 2001

PROJECT:	Tunnel Boring Machine Supply Guidelines North America
POSITION:	Expert / Consultant
CUSTOMER:	Herrenknecht AG Germany
FOR:	Herrenknecht USA

Project included the preparation of detailed electrical, mechanical, and operational design and supply specifications for the Minneapolis Light Rail Earth Pressure Balance TBM.

February 2001-October 2003

PROJECT:	Golden Gate Bridge Rope House Structure Retrofit
POSITION:	Project Engineer / Consultant
CUSTOMER:	Shimmick / Obayashi J.V.
FOR:	CalTrans

Project consisted of evaluating the temporary power requirements and ventilation of the structure during the reconstruction of the Rope House Structure.

May 2001 - July 2002

PROJECT:	Slurry Shield Cutterhead Drive System Torque Evaluation
POSITION:	Expert / Consultant
CUSTOMER:	Frank Coluccio Construction Co.
FOR:	Frank & Joe Coluccio

Project consisted of evaluating the drive system on a Herrenknecht Slurry Shield, and to provide a price for modifying the cutterhead drive system so that the contractor could pursue a tunneling project in Portland Oregon. Following the implementation of the preliminary changes the STBM achieved and exceeded the specified torque. Provided expert testimony before the arbitrator in the resulting dispute between the STBM Manufacture and the Contractor.

February 2000 – October 2005

PROJECT:	Upper Diamond Fork Tunnel and Pipeline ($53,000,000)
POSITION:	Project Engineer / Consultant
CUSTOMER:	Obayashi / W.W. Clyde J.V
FOR:	U.S. Bureau of Reclamation

Project consisted of a design/build water supply tunnel, a continuation of the Central Utah Project. The scope of work included an intake shaft approximately 800-ft deep, tunnel approximately 24,000-lf in length bored at 12.5-ft diameter. The contractor selected a hard rock Robbins tunnel-boring machine remanufactured by Herrenknecht Tunneling Systems.

September 1998 to October 1998

PROJECT:	Dispute Resolution
POSITION:	Expert / Consultant
CUSTOMER:	CRS New England Pipe
FOR:	John Boyer, General Manager

Evaluated the claim submitted by the Microtunneling contractor that the Reinforced Concrete Pipe (RCP) supplied by CRS New England Pipe was of a defective design, and had failed causing the contractor to excavate and remove the concrete pipe. The claim stated that the gasketed joint was incapable of withstanding the forces exerted by the jacking system, as had been specified.

July 1998 - September1999

PROJECT:	Direction Drill Design and Equipment Supply
POSITION:	Consultant / Designer / Facilitator
CUSTOMER:	UTILIX Corp.
FOR:	B&W Controls

Project consisted of the evaluation, design, engineering, and manufacture of the electrical control systems for UTILIX Corps. Directional drilling system.

1997 - 2005

PROJECT:	Sir Adam Beck Hydro Electric Project Water Tunnels ($300,000,000)
POSITION:	TBM Operations Manager / Consultant
CUSTOMER:	Niagara Tunnelers JV (Obayashi / Kanadin J.V.)
FOR:	Ontario Hydro

The project consisted of approximately 6.5-miles of 48-ft diameter tunnel driven at an initial 11% decline and exiting at an 11% incline. The project will divert water from the Niagara River at night and will be release back into the river during the day driving massive turbines used to generate power during daytime peak demand period. The TBM will be a Herrenknecht hard rock double gripper shielded tunnel-boring machine, with a pre-cast concrete segmental lining installed within the shield section of the machine. Haulage of muck will be performed with conveyor belts and supply of segments and supplies is yet to be defined.

1997 - Present

PROJECT:	East Boulder Project Access Tunnels
POSITION:	Project Engineer/Consultant
CUSTOMER:	Stillwater Mining Company
FOR:	East Boulder Project

The project consisted of twin 19,000-lf, 15-ft diameter access tunnels for the development of the East Boulder Access Drifts, to enhance the development Stillwater Mining Co. Palladium and Platinum mine. East portal Robbins Hard Rock tunnel boring machine, West portal CTS hard rock tunnel boring machine.

July 1997 – May 2003

PROJECT:	Inland Feeder Project Tunnels, ($201,000,000)
POSITION:	Expert / Consultant
CUSTOMER:	Metropolitan Water District of Southern California's
	Mr. Shel Coudray, Resident Engineer, Arrowhead East Tunnel
	Mr. John Townsend, Resident Engineer, Arrowhead West Tunnel
	Mr. Ron Drake, Resident Engineer, Badlands Tunnel.
FOR:	Metropolitan Water District of Southern California

The project consisted of 43.7-mile alignment of large diameter tunnels and pipelines, which connected the California and Colorado Aqueducts in Southern California. The geological conditions included granite gneiss, marble, sandstone, and quartz monzonites. The rock varied from massive, hard, strong, and very abrasive to very blocky, seamy, and crushed. Sheared rock and raveling/squeezing ground were encountered in various areas. In addition, the tunnels alignment crossed active splays of the San Andreas Fault in three locations.

With a bored diameter of 18-lf, temporary concrete segments were installed with a final lining cast in place resulting in a finished diameter of 12-lf. The tunnels projects are identified as Arrowhead East, 31,495-lf, Arrowhead West, 20,341-lf and Badlands 43,235-lf.

The Joint venture of Shank/Balfour Beatty was awarded all three of these contracts. Subsequently the contractors decided to build their own Tunnel Boring Machines, and submitted the required documents.

January 1997 – April 1999

PROJECT:	Dispute Resolution Involving Three Separate Cases
	Nova Group vs. Soltau Microtunneling:
	Perron vs. Nova Group:
	Kona Cold Lobster vs. Nova Group:
POSITION:	Expert / Consultant
CUSTOMER:	Nova Group Inc., Napa, California

Nova Group vs. Soltau Microtunneling:
Breach of Contract, following the results of the investigation and subsequent modification made to the Soltau Micro Tunnel Boring Machine.

Perron vs. Nova Group:
Wrongful Death following underwater retrieval of Soltau, MTBM in 1996.

Kona Cold Lobster vs. Nova Group:
Wrong full Death following head on collision between Iron Man Tri-athlete and Kona Cold Lobster delivery van.

January 1997 – October 1997

PROJECT:	San Francisco Tlalnepantla - 11 km., 3.8 m. diameter tunnel, driven through basaltic formation.
POSITION:	Consultant/Expert
CUSTOMER:	COTRISA-AG/Constructora Andrade Gutierrez, Mexico City, Mexico
FOR:	Mexico City

March 1996

PROJECT:	Provided TBM equipment and engineering to modify Soltau RVS800AS in San Diego, California to match modifications made on machine located at Nova Group Project, Kailua Kona, Hawaii.
POSITION:	Consultant / Designer / Facilitator
CUSTOMER:	Soltau Micro-Tunneling Amnann Group, Luneburg, Germany
FOR:	Soltau Micro-Tunneling USA.

February 1995 – August 1997

PROJECT:	NELHA's Kona Shore Crossing Project
POSITION:	TBM Operations Manager / Project Field Manager / Consultant
CUSTOMER:	Nova Group Inc., Napa, California
FOR:	Natural Energy Laboratory of Hawaii Authority (NELHA) , Keahole Point, Kona, Hawaii

The boring of twin suction intake pipelines, each 1,040 feet in length, 68 inch in diameter for the Natural Energy Laboratory of Hawaii Authority's experimental thermal energy conversion project.

A Micro-Tunnel Boring Machine (MTBM) was procured by Nova Group Inc. from Soltau Microtunneling GmbH, Germany in 1993. The MTBM Model RVS800AS was remote controlled from the surface and was originally designed to operate in 100% permeable conditions. The motor was hydraulically driven at 170HP, yielding 195,000 ft/lbs of torque. The cutterhead outside diameter was 68.75 inches, and utilized seven 13.5-inch button type carbide cutters. Muck passed through the cutterhead spokes and entered the cone crusher that could handle boulders up to 22 inches in diameter.

Four jets in the cutterhead, controlled by a bypass valve, scoured the face in the event of overcharging the slurry chamber. The slurry chamber was charged with a 6 inch, 100 hp. Variable Frequency Drive controlled gravel pump. A paralleled pump located 25 feet from the face pumped the resulting slurry of 3 inch minus aggregate. It was designed for underwater recovery and was fitted with four bulkheads to seal the unit against flooding.

Ground support consisted of a .409 inch welded steel pipe, welded and jacked in 20-foot sections. Inside was placed a 54-inch concrete pipe, in 12-foot lengths with a banded joint ring. Geological conditions consisted of lava flow formations with a very dense upper layer rock cap, over basaltic boulders, clinker, and basaltic sands. This formation was the result of hot lava flowing into the sea. Compressive strength was up to 20-30 psi.

The tunnels were driven from a center shoreline shaft located approximately 8 feet from the edge of the Pacific Ocean. This would allow for a shorter drive inland and an offshore drive of approximately 575 feet, utilizing the same shaft.

In August 1995 GOMEZ INTERNATIONAL INC. was retained by Nova Group Inc. to evaluate and make recommendations regarding the RVS800AS's inability to perform as had been anticipated. This work included cutterhead stalling, variable frequency drive failures, hydraulic power pack performance, electrical equipment

failures, and overall project equipment performance on the 8.5 percent decline ocean drives, as well as ocean retrieval.

February 1993 - 1997

PROJECT:	Magma Copper Company's San Manuel Mine, Lower Kalamazoo TBM Project.
POSITION:	Project Engineer / TBM Operations Manager / Consultant / Designer
CUSTOMER:	Magma Copper Company/Engineering Building, San Manuel, Arizona
FOR:	Magma Copper Company

Access tunnels for the primary drifts in the Lower Kalamazoo (Lower "K") copper ore body, 33,200 feet in length, 15 foot in diameter. The tunnel construction took place at the 3,440 foot and 3,600 foot levels. The Robbins 1680 horsepower TBM #156-275 was specifically designed to negotiate 250-foot radius curves, and traverse grades of up to 5.5 percent. Designed to operate in temperatures of between 112 and 119 degrees F., it traversed eleven major fault zones. The TBM was constructed to conform to a shaft size of 6.8 feet in width, 13.6-foot depth and 39 foot high, with a maximum hoist drawbar capacity of 24-static tons. Contractors on site were Frontier Kemper Constructors, Evansville, Indiana, and Dielmann Haniel of Dortmund, Germany (FKC/DH Joint Venture). The trailing floor was constructed at Frontier Kemper's shop in Evansville, Indiana as a joint venture between FKC/DH and Magma Copper Company.

October 1991 - January 1991

PROJECT:	Pacific Gas and Electric's Grizzly Project, Quincy, California.
POSITION:	Projects Field Manager / TBM Operations Manager / Project Engineer / Consultant
CUSTOMER:	Harrison Western Corporation
FOR:	Guy F. Atkinson Construction

Project consisted of 12,000 feet of hydroelectric penstock tunnel excavated through granite with Robbins hard rock TBM #119-222, leased from the Harrison Western Corporation. The 11-foot diameter TBM was rebuilt and upgraded from 600 hp. to 1000hp. at The Robbins Company facility, Kent, Washington.

June 1991 - February 1993

PROJECT:	Lesotho Highlands Water Project
POSITION:	Projects Field Manager / TBM Operations Manager / Project Engineer / Consultant
CUSTOMER:	Harrison Western Corporation
FOR:	Lesotho Highlands Project Contractors, Kingdom of Lesotho (Africa)

Water transfer and diversion tunnels form part of Phase 1-A of the Lesotho Highlands Water Project. Project work performed by the Lesotho Highlands Project Contractors for the Kingdom of Lesotho within the Republic of South Africa. A joint venture consortium, which included Zublin Contracting, Germany; Spie Batignolles, France; Campenon Bernard SGE, France; Balfour Beatty, United Kingdom; and LTA, Republic of South Africa. The combined tunnel drive in phase 1-A was 45 km. in length with an excavated diameter of 5 meters. All tunnel projects were connected in series to an underground power station. Tunnels were excavated through basalt and sandstone formations. Ground support methods included rock bolts, welded wire, arch sets, and shotcrete.

Hololo/Noagajane Site: 14 km. - length, Harrison Western Corporation modified, remanufactured Robbins TBM Model 186-206, 5.1-meter diameter, with three individual headings, (Harrison Western back-up).

Muela Site: 12 km. - length, Robbins TBM Model 167-266, 5.1 meter diameter (Emil Lechner back-up).

Hlotse Site: 14 km. - length, Robbins TBM Model 167-267, 5.1 meter diameter (Emil Lechner back-up).

Katse Site: 12 km. - length, Atlas-Copco TBM Jarva Mark 15, 5.1 meter diameter (Fosdalen back-up).

PROJECT:	Robbins Tunnel Boring Machine 186-206 Remanufacture
POSITION:	Projects Field Manager / TBM Operations Manager / Project Engineer / Consultant
CUSTOMER:	Harrison Western Corporation, Wheat Ridge, Colorado
FOR:	Lesotho Highlands Water Project, Kingdom of Lesotho, Africa

PROJECT:	Robbins Tunnel Boring Machine 112- Remanufacture
POSITION:	Projects Field Manager / TBM Operations Manager / Project Engineer / Consultant
CUSTOMER:	Harrison Western Corporation, Wheat Ridge, Colorado 80033
FOR:	Grizzly Creek Tunnel Project – Guy F. Atkinson Construction

ASSISTED IN THE PREPARATION OF ESTIMATES FOR THE FOLLOWING PROJECTS:

January 1997 to November 2009:

Estimator / Consultant – Preparation of estimates heavy civil projects, include bridges, dams, tunnels, shafts, and related heavy civil construction project. Scope includes plant and equipment, means and methods, permanent mechanical and electrical, temporary power, temporary support systems including ventilation, de-watering ETC.

- WD2531 San Francisco Bay Tunnel Project 2009 ($215,000,000)
- Manhattan Tunnel Project, New York City N.Y. ($533,000,000)
- U230 Sound Transit, Seattle WA 2009 ($154,139,000)
- U220 Sound Transit, Seattle WA 2009 ($309,200,000)
- Ballard Siphon, Seattle WA 2009 ($30,000,000)
- South Cobb Tunnel, Atlanta GA 2007 ($305,000,000)
- Bradshaw Interceptor, Sacramento CA 2007 (120,000,000)
- Northwest Interceptor Sewer, Sacramento CA 2007
- Brightwater Central, Seattle WA 2006
- Highland Boy Tunnel, Bingham Canyon Mine, UT 2006
- San Vicente Aqueduct Pipeline CA 2005
- Yucca Mountain, South Ramp Nevada Test Site NV 2005
- Brightwater East, Seattle WA 2005
- Sir Adam Beck / Ontario Hydro Re-bid Canada 2005
- North Shore Connector, Pittsburgh PA 2005 (156,500.00)
- Big Sandwash Dam UT 2004 ($31,400,000)
- Eastside Light Rail Tunnels Gold Line Extension, Los Angeles CA 2004

- Colorado River Bridge, Hoover Dam AZ/NV 2004 ($114,000,000)
- Beacon Hill Tunnels and Stations WA 2004 ($279,000,000)
- West Area CSO, Atlanta GA 2004 ($243,288,000)
- MAC M-22 Tunnel, Minneapolis St Paul MN 2004
- North MacGregor Tunnel, Houston TX 2004
- Little Walnut Tunnel Project, Austin TX 2004 ($12,700,000)
- Shoal Creek Tunnel Project, Austin TX 2004 ($8,900,000)
- Eastside Extension Light Rail Tunnels and Stations 2004 ($640,000,000)
- Park Ave. Tunnel, New York City NY 2003
- Mormon Temple Tunnel UT 2003
- Baumgartner Tunnel, St. Louis, MO 2003
- Upper Diamond Fork Tunnel and Tanner Ridge Tunnel Project Change Order No.6 UT 2003
- Big Walnut Tunnel Project, Columbus, OH 2003
- Tanner Ridge Tunnel and Pipeline, Spanish Fork, UT 2002 ($22,000,000)
- Nancy Creek Shafts and Tunnels, Atlanta, GA 2002 ($131,000,000)
- Golden Gate Bridge, Rope House and Pier Retrofit, CA 2001 ($150,000,000)
- Upper Diamond Fork Tunnel, Spanish Fork, UT ($53,000,000)
- Arrowhead East and West Tunnels Re-bid, San Bernardino, CA ($242,000,000)
- Northeast Interceptor Sewer 2002
- Milwaukee Tunnel Estimate WI 2001
- Arrowhead East & West San Bernardino CA 2001
- Benicia-Martinez Bridge CA 2001
- Mission Valley San Diego State University Light Rail Station CA 2001
- Olivehaven Dam, San Diego County, CA 2001
- Northwest Side Relief Sewer, Milwaukee, WI, ($116,800,000)
- Minneapolis/St. Paul Light Rail Tunnels and Station, MN 2000 ($110,000,000)
- North Outfall Interceptor Sewer (ECIS) Tunnel, Los Angeles, CA 2000 ($262,000,000)
- Mission Valley East LRT Tunnels and Station, San Diego, CA
- East Central Interceptor Sewer Tunnel, Los Angeles, CA ($235,000,000)
- Chattahoochee, Waste Water Tunnel, Atlanta, GA 2000 ($103,000,000)
- Carquinez Bridge Project __ CA 2000 ($0000)
- Upper Diamond Fork Tunnel, Spanish Fork, UT 1999 ($53,000,000)
- Denny Way / Lake Union CSO Project, Mercer St. Tunnel 1999 ($00000)
- Braintree Weymouth Wastewater Tunnel, Weymouth, MA 1999 ($73,000,000)
- Fermilab Collider, NUMI Halls & Tunnels, accelerator tunnel, underground halls and surface buildings, 1999 ($30,500,000)
- Mill Creek, Waste Water Tunnel, Cleveland, OH 1999 ($51,500,000)
- Rochester Transit Authority, interstate highway and bridges, NY($240,000,000)
- Sir Adam Beck, Hydro Electric Water Supply Tunnel, Ontario Canada 1998 ($300,000,000)

PROFESSIONAL AFFILIATIONS and MEMBERSHIPS:

ASCE - American Society of Civil Engineers
ASME - American Society of Mechanical Engineers
AUA - American Underground Construction Association
AIME - American Institute Metallurgical and Petroleum Engineers
IBEW - International Brotherhood of Electrical Workers
IEEE - Institute of Electrical and Electronic Engineers
SME - Society of Mining and Engineering
NFPA – National Fire Protection Association

PROUD SPONSOR OF:

University of Arizona San Xavier Mining Laboratory, Tucson, Arizona
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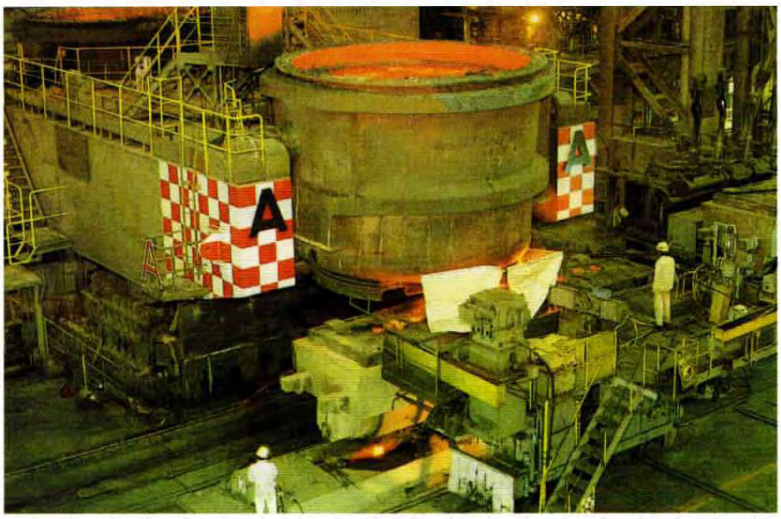
■新日本製鐵（株）大分製鐵所:連続鋳造設備



主要製品

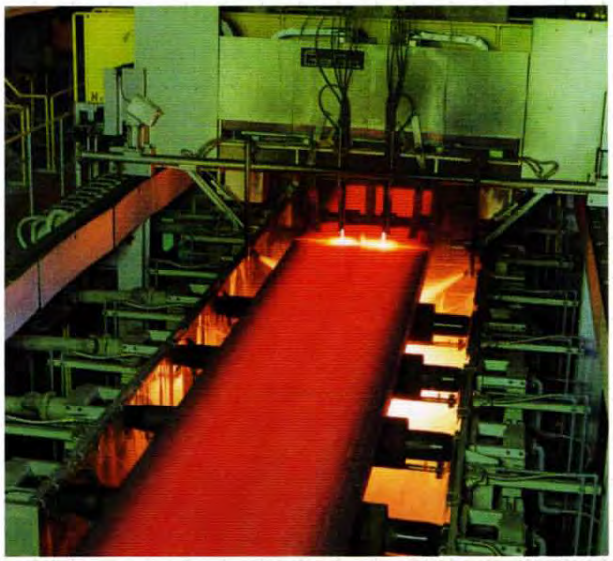
- ●モールドO-リング
  Mold O ring
- ●クッションブッシュ
  Cushion bush
- ●テレスコピック
  Telescopic
- ●MV継手
  MV joint

■JFEスチール（株）東日本製鉄所 千葉地区:高炉

主要製品

- ●ベルパッキン
  Bell packing
- ●ベルレス炉頂パッキン
  Bell-less furnace top packing
- ●ランスシール
  Lance seal

■（株）神戸製鋼所:連続鋳造設備



主要製品

- ●ヘキサダスターリング（DRT）
  Hexa-duster ring（DRT）
- ●ヘキサダストワイパー（DWT）
  Hexa-dust wiper（DWT）
- ●ヘキサプロップシール（PS）
  Hexa-prop seal（PS）
- ●ヘキサスプリットワイパー（SW）
  Hexa-split wiper（SW）
- ●リップパッキン（DL）
  Lip packing（DL）

■JFEスチール（株）西日本製鉄所　倉敷地区:電気亜鉛鍍金設備

主要製品

- ●ヘキサチューブシール
  Hexa tube seal
- ●吸振ラバーシール
  Vibration absorbing seal
- ●エッジマスクシール
  Edge mask seal

■JFEスチール（株）東日本製鉄所　千葉地区:熱延工場

主要製品

- ●ヘキサダストワイパー（DWT）
  Hexa-dust wiper（DWT）
- ●スケールシール（WK）
  Scale seal（WK）
- ●W/Rシール
  W/R seal
- ●水切りスクレーパ
  Draining scraper
- ●オイルシール（SG）
  Oil seal（SG）
- ●オーパスシール（OP）
  OPAS seal（OP）
- ●セパートシール（SP）
  Separt seal（SP）

■新日本製鐵（株）堺製鐵所:粗圧延機

主要製品

- ●ヘキサスプリットワイパー（SW）
  Hexa-split wiper（SW）
- ●軸偏芯シール（SWS）
  Swing seal（SWS）
- ●ヘキサダストワイパー（DWT）
  Hexa-dust wiper（DWT）
- ●スケールシール（WK）
  Scale seal（WK）
- ●オイルシール（SG）
  Oil seal（SG）

Hexa-dust wiper (DWT)

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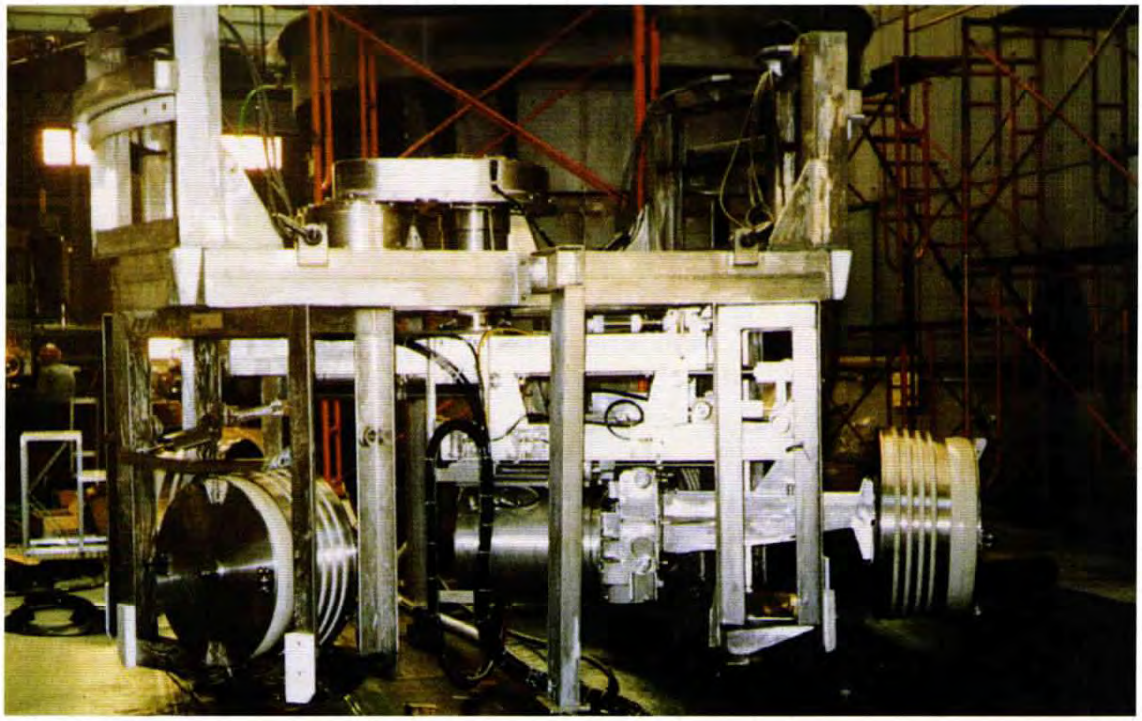

主要製品

- ●ヘキサチューブシール
  Hexa tube seal
- ●プールゲートパッキン
  Pool gate packing
- ●DSゲートパッキン
  DS gate packing
- ●ダブルカバーパッキン
  （プルトニウム保管容器）
  Double cover packing
  (plutonium storange container)
- ●R/Vノズルプラグ
  R/V nozzle plug
- ●S/Gノズルプラグ
  S/G nozzle plug

■原子力発電　三菱重工業（株）神戸造船所:新燃料輸送容器

主要製品

- ●キャスクOリング
  Cask O ring
- ●ダブルカバー
  Double cover
- ●20ℓビン
  20-liter bottle

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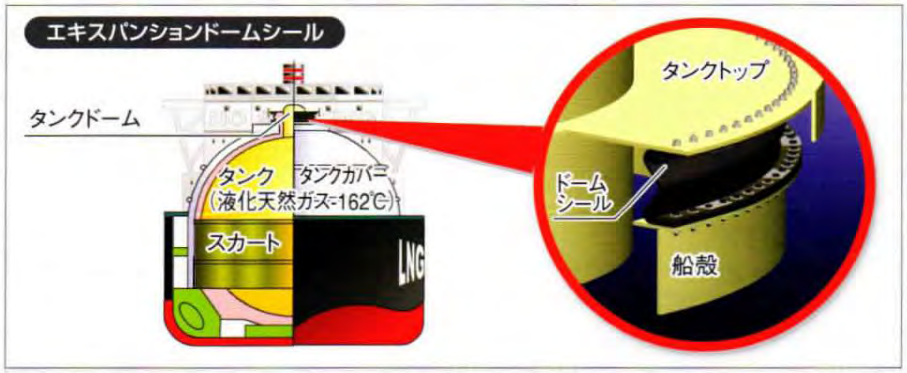

主要製品

- ●ハッチカバーリップパッキン
  Hatch cover lip packing
- ●エキスパンションドームシール
  （LNG船・LPG船用）
  Expansion dome seal
  (for LNG/LPG ship)
- ●ダイヤフラムガスケット
  （LPG船用）
  Diaphragm gasket
  (for LPG ship)

■風力発電　三菱重工業（株）長崎造船所:1000kw風車

主要製品

- ●HWS型オイルシール
  （主軸部受用）
  HWS type oil seal
  (for main shaft bearing)
- ●HWB型オイルシール
  （旋回輪軸受用）
  HWB type oil seal
  (for turning wheel bearing)
- ●防振ゴム（発電機用）
  Anti-vibration rubber
  (for power generator)
- ●円筒型防振ゴム（増速機用）
  Cylindrical anti-vibration rubber
  (for speed-up gear)

■火力発電　三菱重工業（株）長崎造船所:石炭粉砕機

主要製品

- ●スイングシール（SWS）
  Swing seal (SWS)
- ●ヘキサダストワイパー（DWT）
  Hexa dust wiper (DWT)
- ●ヘキサスプリットワイパー（SW）
  Hexa split wiper (SW)
- ●ダストシール
  Dust seal
- ●テーブル用シール
  Table seal

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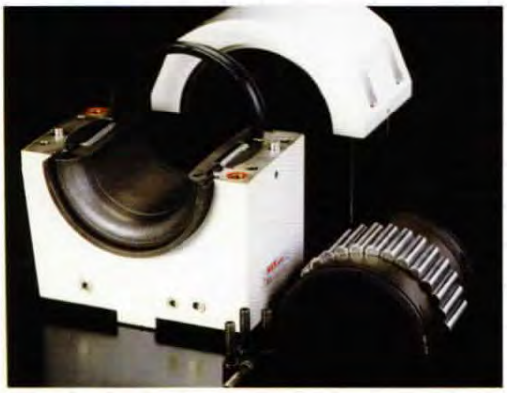
■日本精工（株）:分割ベアリング



主要製品

- ●2分割ベアリングシール
  Split bearing seal
- ●密封ベアリングシール
  Sealed bearing seal

■川崎重工業（株）:φ8.78m英仏海峡トンネル用TBM

主要製品

- ●VDシール
  VD seal
- ●エマージェンシーシール
  Emergency seal
- ●モルタルシール
  Mortar seal
- ●耐圧ダストワイパー（DWH）
  Pressure-resistance dust wiper（DWH）

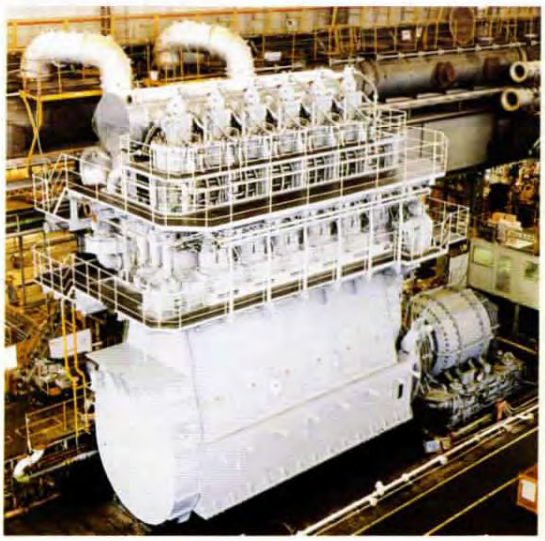
●水中検査用船底プラグ～各種エンジン用耐熱Oリングまで納入しています。
We deliver all kinds of products from ship bottom plugs for underwater survey to heat-resistant O-rings for various types of engines.

造 船 Shipbuilding

ディーゼルエンジンの寿命伸長に貢献する特殊配合の弗素ゴム、シリコーンゴムのOリングをはじめ、様々なシール、パッキンを製造しています。

We manufacture O-Rings of the special formula fluorine rubber and the silicon rubber that contribute to keeping a shipbuilding disel engine in good condition, seals for packing, and other various seals.

■三菱重工業（株）神戸造船所 UEC85LS ディーゼルエンジン



主要製品

- ●耐熱Oリング（スルザー、B&W、UEC）
  Heart resistance O ring（SULZER,B&W,UEC）
- ●船底プラグ
  （UNDER WATER SARVEY）

MUTSUBISHI RUBBER CO., LTD.
MAIN PRODUCTS

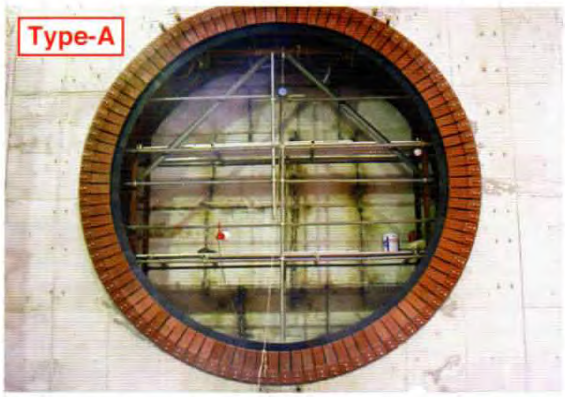
● 製品に要求されるさまざまな振動、地震あるいは、複雑に変位する構造物の安全性を確保します。
Providing all kinds of vibration resistance required by products and ensuring the safety of buildings against earthquakes and complex displacement forces.

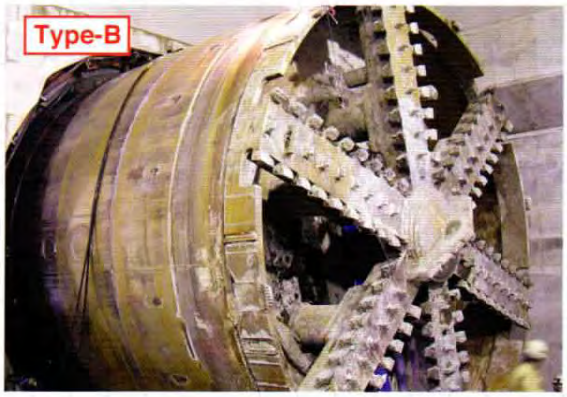
土木 Civil Engineering Works

トンネル・高架橋の止水及び耐震用パッドを自社開発。
様々な土木現場で活用され、今後も社会に役立つ製品づくりを目指しています。

We have developed the cut-off wall and the pad for earthquake-proof in tunnel elevated bridges. We believe that these products are useful to society because they are utilized in various civil engineering construction sites.

■エントランス





主要製品

- ●RIPP Type-A（発進用）
  RIPP Type-A (for starting)
- ●RIPP Type-B（到達・引抜用）
  RIPP Type-B (for ending/drawing out)
- ●RIPP Type-C（発進・到達用）
  RIPP Type-C (for starting/ending)

■高架橋

主要製品

- ●ヘキサ自在シール（MBK）
  Hexa universal seal (MBK)
- ●間隔調整形シール（ST）
- ●平滑目地材（PF）
  Paralel fastener (PF)

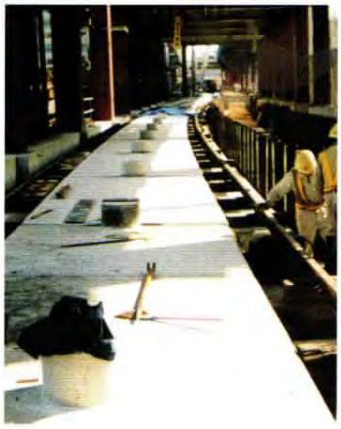
● 振動・騒音の防止に効果を上げている線形バネ定数を有した当社オリジナルのパッドや支承を納入しています。
We deliver original pads and bearings with linear spring coefficients that raise the bar on the effective prevention of vibration and noise..

軌 道 Rail Tracks

振動・騒音の防止に効果を上げている線形バネ定数を有したパッドや支承。当社で設計開発した特殊な形状により、取付けの簡素化やコストダウンにもその効果を発揮しています。

The pad and bearing with the alignment spring take the effect of prevention against orbital vibration and noise.We have applied a simplification and cost saving measure in developing a special form to handle vibration and noise prevention.

■省力化軌道製品



主要製品

- ●レールパッド
  Rail pad
- ●マクラギパッド
  Railroad tie pad
- ●弾性支承ゴム
  Elastic rubber bearing

● 土木・配管工事用の製品は、取付工数低減を重視した設計をしています。
Products for construction and pipe laying are designed emphasizing reduced installation work loads.

その他 Others

異物混入の防止、防水、耐圧用治具、溶接用治具などさまざまな配管用製品を納入しています。

We deliver all kinds of products for piping systems, including jigs that prevent the entry of foreign substances, waterproof jigs, pressure-resistant jigs, and jigs for welding.

■ヘキサプラグ

主要製品

- ●O型（一般外面用）
  O type（for general outer surfaces）
- ●OS型（埋没外面用）
  OS type（for embedded outer surfaces）
- ●I型（管路内面用）
  I type（for within pipes）
- ●IC型（長尺ボルト付管路内面用）
  IC type（for within pipes with long bolt）
- ●G型（ガスシール用）
  G type（for gas seal）
- ●WSV型（下水道管路用）
  WSV type（for sewage pipes）
- ●WG型（耐圧ガス用）
  WG type（pressure resistance for gas seal）
- ●W型（耐圧テスト用）
  W type（pressure resistance testing）
- ●D型（放水用）
  D type（for water discharge）
- ●F型（溶接部検査用）
  F type（Flange Pressure resistance testing）

その他、分割型プラグ、小口径プラグ、大口径プラグ、被爆撲滅鈴プラグなど多種多様な製品があります。

● グループ三社一体となり、より幅広いお客様のニーズにお応えします。
Bringing together the combined power of three group companies, we meet a wider range of customer needs.

グループ会社のご案内 Information on Group Companies

日本ヴィクトリック株式会社 THE VICTAULIC CO.,OF JAPAN,LTD.

パイプ用継手のトップメーカー
Top manufacturer of pipe joints

日本ヴィクトリック株式会社は、ヴィクトリックの商号で、汎用継手ヴィクトリックジョイントをはじめ、各種ヴィクトリック型伸縮可撓継手及び補修継手を販売している管継手のトップメーカーです。その活動のフィールドは、官公庁、電力、重工、造船業など多方面に広がっており、皆様から高い評価を得ております。今後も特殊技術を生かした新製品開発を積極的に行い、豊かな未来を築くため邁進しています。

Japan VICTAULIC® incorporated company is the trade name of a VICTAULIC®, and is the biggest manufacturer of the pipe joint which began general-purpose joint, Victaulic joint, and has publicated various VICTAULIC® type flexible joints and the repair joint.Goverment and municipal offices, electric power, heavy industry, the shipbuilding industry, etc. have broad developed in many fields, and, as for the field of the activity, high evaluation has been obtained from you.
It is striving in order to perform positively new product development in which special technology was employed efficiently and to continue to build the rich future.

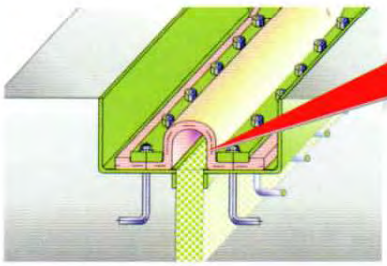
■ジョイントゴムリング

関西新空港／Kansai International Airport

主要製品

●ヴィクトリックジョイントゴムリング
VICTAULIC joint rubber ring

■角型可撓継手



主要製品

●FLEX RUBBER SEAL Type-Ω
FLEX RUBBER SEAL Type-Ω

株式会社ジャビコ JAVICO CO.,LTD.

各種シーリング材・ゴム製品・接着剤の専門商社
Trading company specializing in all kinds of sealing materials, rubber products, and adhesives

当社は、シリコーン及びその製品、各種樹脂、絶縁材料、工業用ゴム製品などを扱う企業としてスタート。その後、電磁波遮蔽シート、各種シーリング材、接着剤などの商い量拡大とともに、全面販売組織の充実を図ってまいりました。現在は、新素材の開発に取り組み、堅実な基礎を固めると同時に、大きな飛躍発展を期しております。

Our company started as a company treating silicone and its product, a resin product, insulated material, and the rubber product for industry. Then, the amounts of trades, such as an electromagnetic wave sield sheet, sealing material, and adhesives, were expanded, and I have aimed at the substantial complete selling organization.

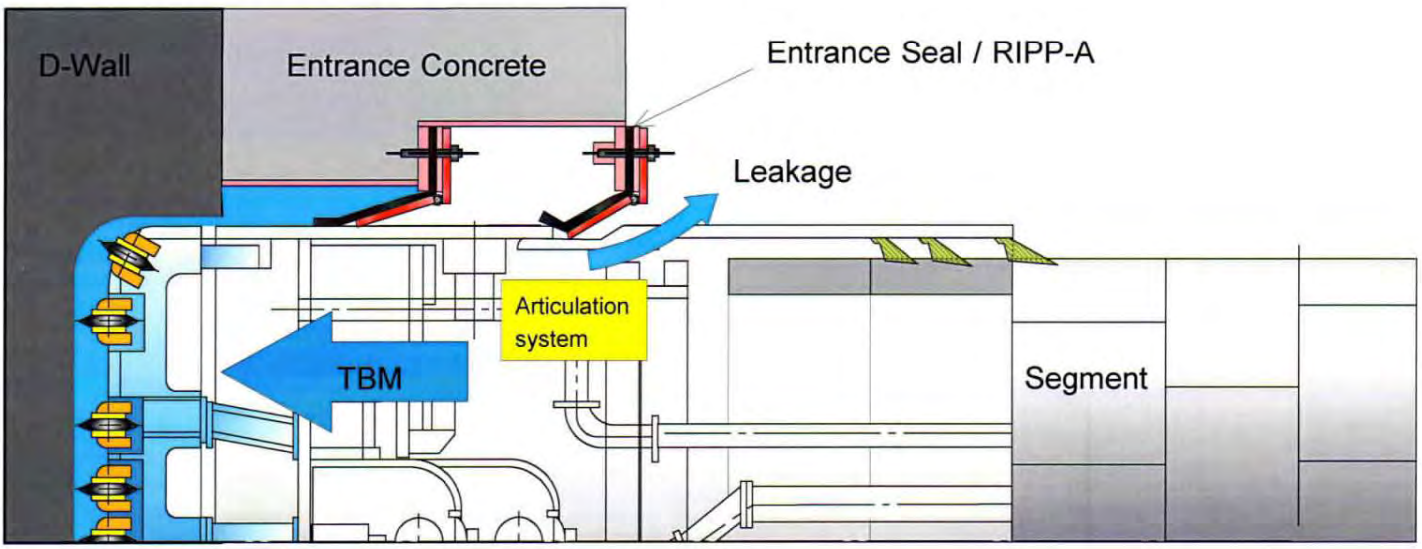
RIPP Type-D
DOGLEG-SEAL

Reasons for using the Entrance seal of double-layer style

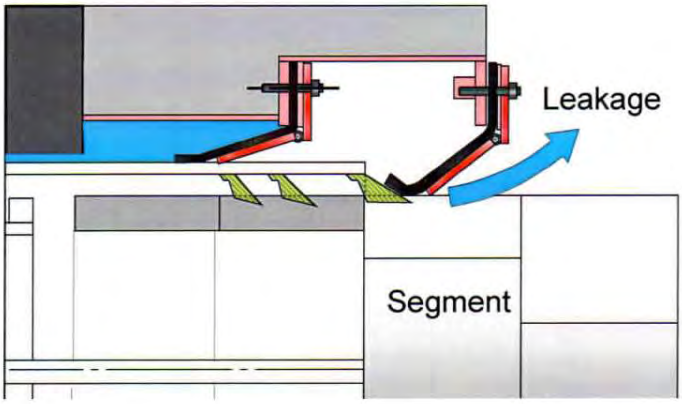
1. More safty sealing

2. Since the seal is difficult by single-layer style to the gap of Articulation of TBM or sift from TBM to Segment

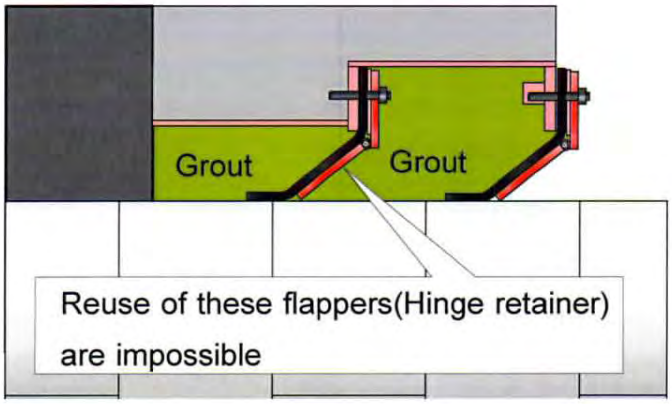
◆ At the position of articulation system of TBM



◆ Sift from TBM to segment

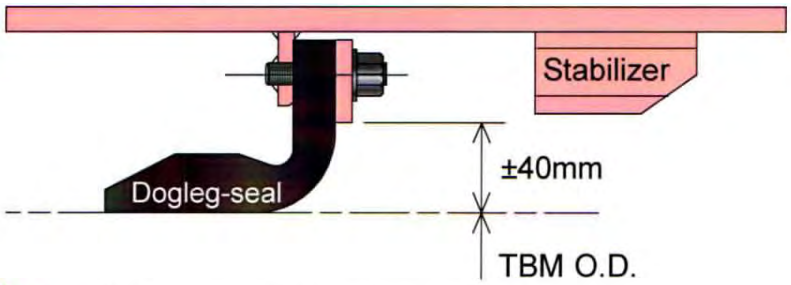


◆ Demerit



Performance of the Dogleg-seal

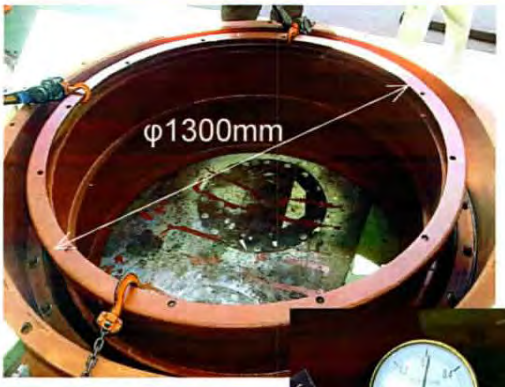
- Pressure resistance; 0.3MPa
- Allowable decentralization of TBM; ±40mm
- Material; Special compounded rubber



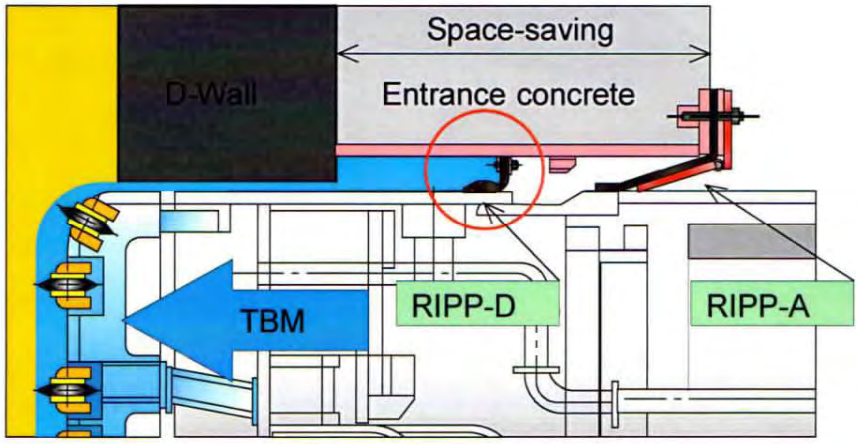
Merit: Compare with double-layer RIPP-A

- The length of Entrance concrete can be shortened
- The seal effect equivalent to double-layer RIPP-A
- Economical

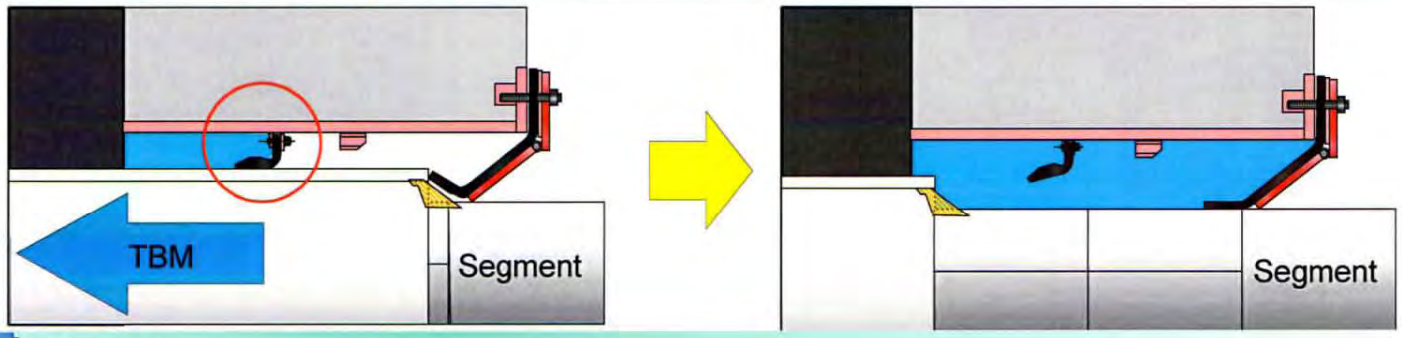
Mock-up test



At the position of articulation system of TBM



Sift from TBM to segment



Contact us

North, Central and South America Sales and Service Representative

GOMEZ INTERNATIONAL INC.
(*The Construction, Mining and Tunneling Standard for Excellence*)
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GomezInternational.com
info@gomezinternational.com

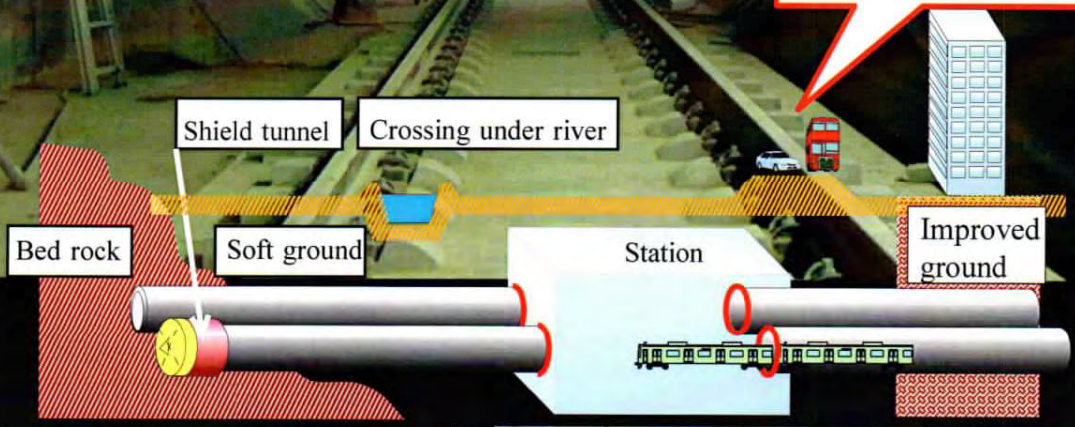
Let our team of experts assist you with the successful completion of your project.

Design & Manufacture

MUTSUBISHI RUBBER CO.,LTD.

FLEX RUBBER SEAL Ω

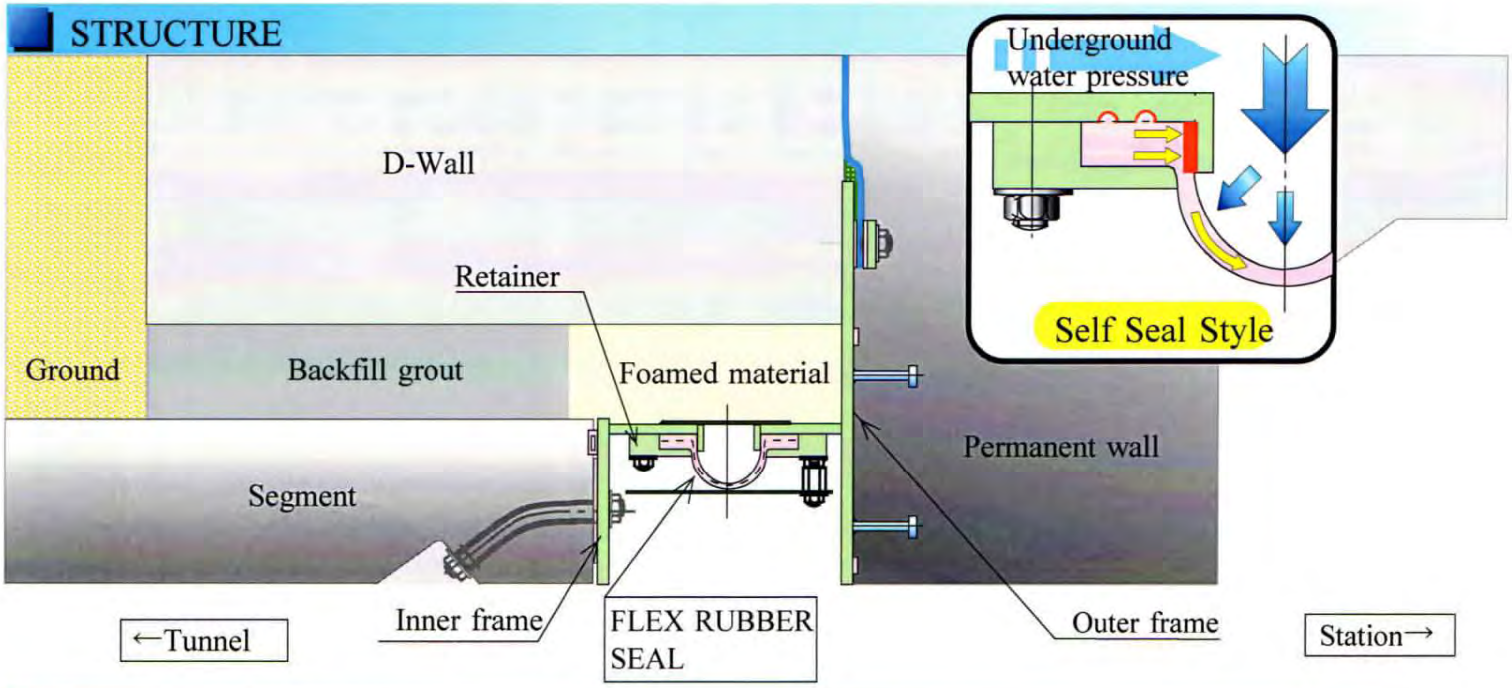
— Sectional view at red circle



『Flex Rubber Seal : Ω-type』 is used for the interface between subway tunnel and main station structure, to absorb abnormal ground movement and deflection which are usually generated by earthquakes, unforeseen subsidence etc, thereby securing safety of the tunnel structure

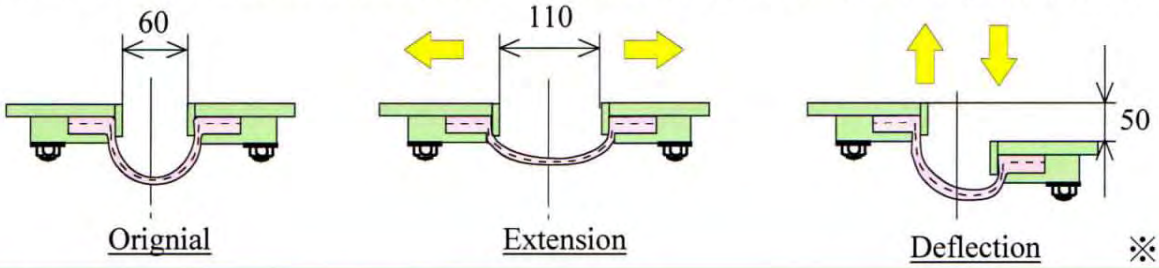
MUTSUBISHI RUBBER CO., LTD.

STRUCTURE



PERFORMANCE

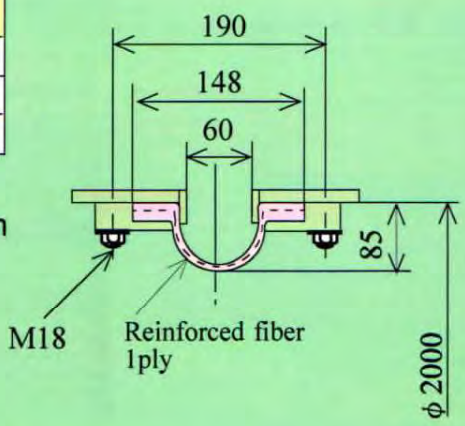
- Absorbs all kinds of deflections and abnormal movement in the structure.
- A layer of reinforced fiber is lined inside the rubber seal to increase its pressure resistance.



Style	Allowable displacement
FS-30	30mm
FS-50	50mm
FS-100	100mm

◆Result of hydrostatic test

- ID of steel pipe : φ2000mm
- Type : FS-50
- Material of rubber : CR
- Pressure : 0.5MPa
- Deflection : 50mm
- Result : No leakage



View during test

CONTACT US

North, Central and South America Sales and Service Representative

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(The Construction, Mining and Tunneling Standard for Excellence)
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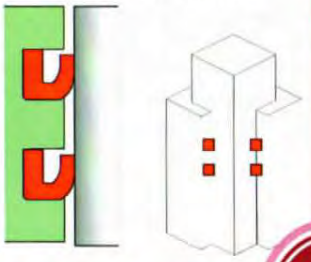
Design & Manufacture

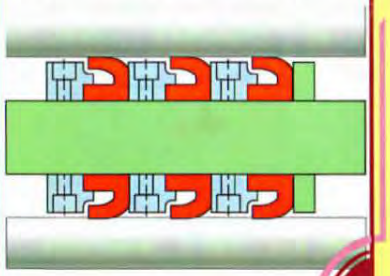
MUTSUBISHI RUBBER CO.,LTD.

SEALS FOR TBM (TUNNEL BORING MACHINE)

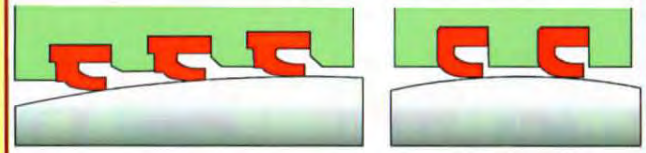
Seals for Over cutter



Seals for Cutter Bearing

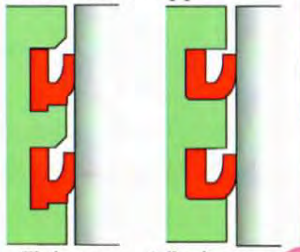


Seals for Articulation / Slide seal

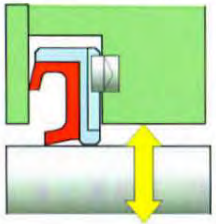


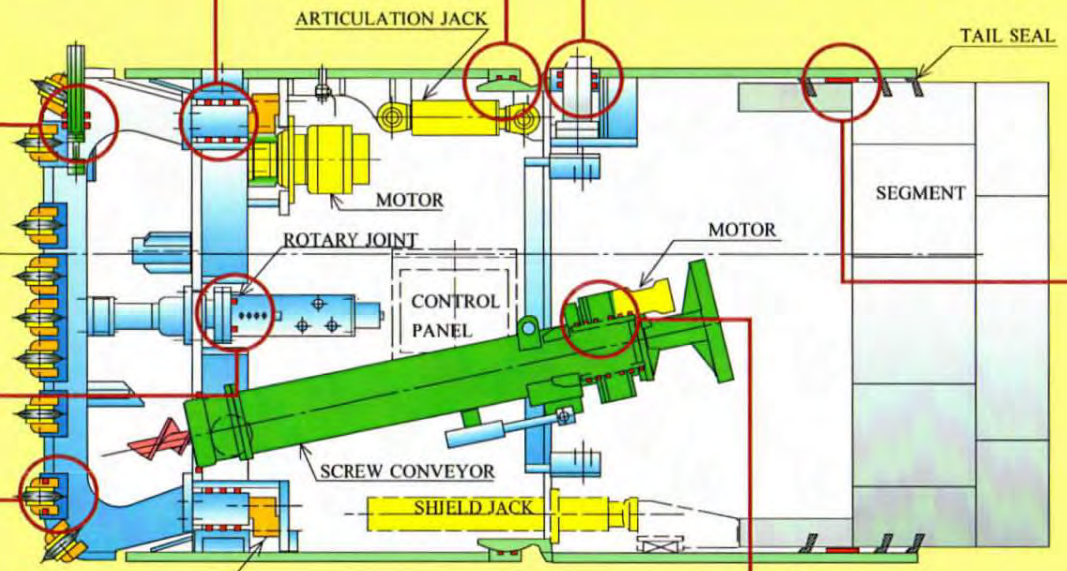
For Spherical surface type

Seals for Gripper

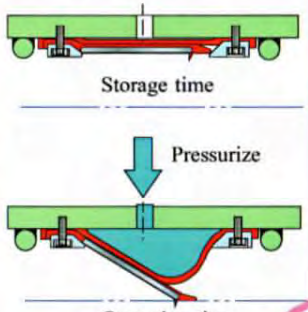


Floating seal for Rotary joint

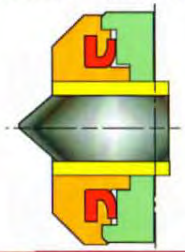




Emergency seal



Seals for Roller cutter



Seal for Screw conveyor

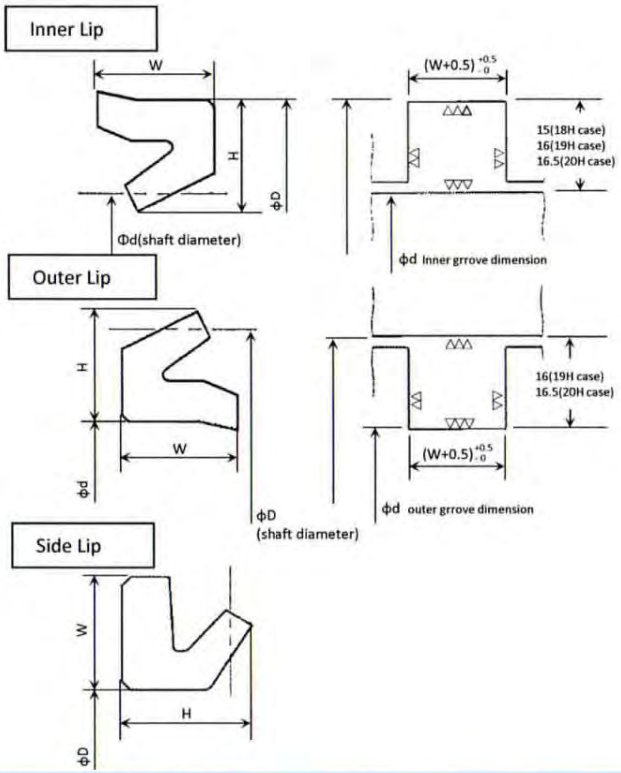
MUTSUBISHI RUBBER CO.,LTD.

Press formed VD Seal size table (mm)

Lip	Inner Lip				Inner Lip	
Material	NBR				Fluorine	
Cross section	16.5(W) X 18(H)	20(W) X 19(H)	20(W) X 20(H)	25(W) X 24(H)	20(W) X 19(H)	20(W) X 20(H)
1	90(d) X 120(D) X 16.5	140(d) X 172(D) X 20	46(d) X 79(D) X 20	420(d) X 460(D) X 25	206(d) X 238(D) X 20	180(d) X 213(D) X 20
2	100(d) X 130(D) X 16.5	206(d) X 238(D) X 20	115(d) X 148(D) X 20	470(d) X 510(D) X 25	270(d) X 302(D) X 20	190(d) X 223(D) X 20
3	110(d) X 140(D) X 16.5	220(d) X 252(D) X 20	120(d) X 153(D) X 20	520(d) X 560(D) X 25	290(d) X 322(D) X 20	200(d) X 233(D) X 20
4	120(d) X 150(D) X 16.5	248(d) X 280(D) X 20	125(d) X 158(D) X 20	570(d) X 610(D) X 25	300(d) X 332(D) X 20	220(d) X 253(D) X 20
5	125(d) X 155(D) X 16.5	270(d) X 302(D) X 20	150(d) X 183(D) X 20	620(d) X 660(D) X 25	310(d) X 342(D) X 20	230(d) X 263(D) X 20
6	130(d) X 160(D) X 16.5	280(d) X 312(D) X 20	160(d) X 193(D) X 20		345(d) X 377(D) X 20	240(d) X 273(D) X 20
7	140(d) X 170(D) X 16.5	290(d) X 322(D) X 20	175(d) X 208(D) X 20		395(d) X 427(D) X 20	260(d) X 293(D) X 20
8	145(d) X 175(D) X 16.5	300(d) X 332(D) X 20	180(d) X 213(D) X 20			
9	150(d) X 180(D) X 16.5	315(d) X 347(D) X 20	190(d) X 223(D) X 20			
10	160(d) X 190(D) X 16.5	338(d) X 370(D) X 20	195(d) X 228(D) X 20			
11	175(d) X 205(D) X 16.5	370(d) X 402(D) X 20	200(d) X 233(D) X 20			
12	180(d) X 210(D) X 16.5	400(d) X 432(D) X 20	212(d) X 245(D) X 20			
13	185(d) X 215(D) X 16.5	410(d) X 442(D) X 20	220(d) X 253(D) X 20			
14	190(d) X 220(D) X 16.5	440(d) X 472(D) X 20	230(d) X 263(D) X 20			
15	200(d) X 230(D) X 16.5	530(d) X 562(D) X 20	240(d) X 273(D) X 20			
16			250(d) X 283(D) X 20			
17			260(d) X 293(D) X 20			
18			265(d) X 298(D) X 20			
19			275(d) X 308(D) X 20			
20			310(d) X 343(D) X 20			
21			340(d) X 373(D) X 20			
22			360(d) X 393(D) X 20			

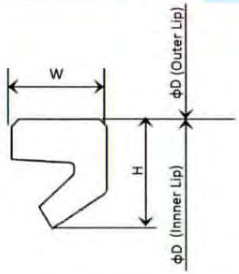
Lip	Outer lip		Side lip		
Material	NBR		NBR		
Cross section	20(W) X 19(H)	20(W) X 20(H)	16.5(W) X 18(H)	20(W) X 20(H)	26(W) X 30(H)
1	162(d) X 194(D) X 20	177(d) X 210(D) X 20	110(D) X 16.5 X 18	330(D) X 20 X 20	198(D) X 26 X 30
2	208(d) X 240(D) X 20		125(D) X 16.5 X 18	420(D) X 20 X 20	298(D) X 26 X 30
3	254(d) X 286(D) X 20		198(D) X 16.5 X 18		370(D) X 26 X 30
4	286(d) X 318(D) X 20		245(D) X 16.5 X 18		
5	307(d) X 339(D) X 20		280(D) X 16.5 X 18		
6	361(d) X 393(D) X 20				
7	469(d) X 501(D) X 20				
8	720(d) X 752(D) X 20				

* We can provide other special sizes. Please ask us.



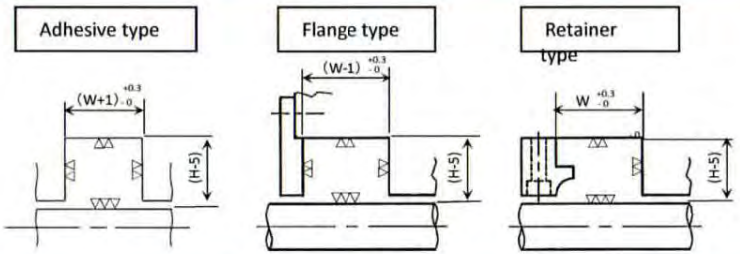
Specification of Large diameter VD Seal

	Nominal size	Amount length changein seal lip after installation	Available size(2002)	
①	20(W)X19(H)	3mm	Inner lip type	Press molded VD Seals are shown at upper list
			Outer lip type	Press molded VD Seals are shown at upper list
②	20(W)X20(H)	3.5mm	Inner lip type	φ1,500mm～
			Outer lip type	φ1,500mm～
③	26(W)X30(H)	5mm	Inner lip type	φ450mm～
			Outer lip type	φ800mm～
④	30(W)X35(H)	5mm	Inner lip type	φ600～φ1,500mm
			Outer lip type	φ2,000mm～
⑤	35(W)X36(H)	5mm	Inner lip type	φ800mm～
			Outer lip type	φ800mm～



Pressure resistance: 0.5MPa

Material : NBR or FKM



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Design & Manufacture

MUTSUBISHI RUBBER CO.,LTD.

RIPP

Remote Inflatable Pressure Packing

HEXA®

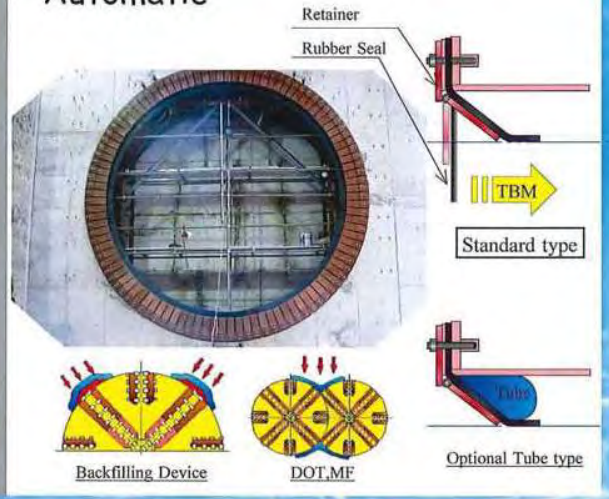
RIPP

Remote Inflatable Pressure Packing

MUTSUBISHI RUBBER Co.,Ltd.

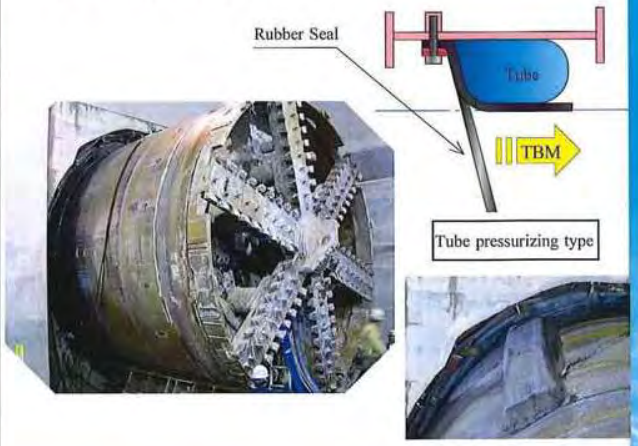
Type-A For Launch of TBM

Automatic



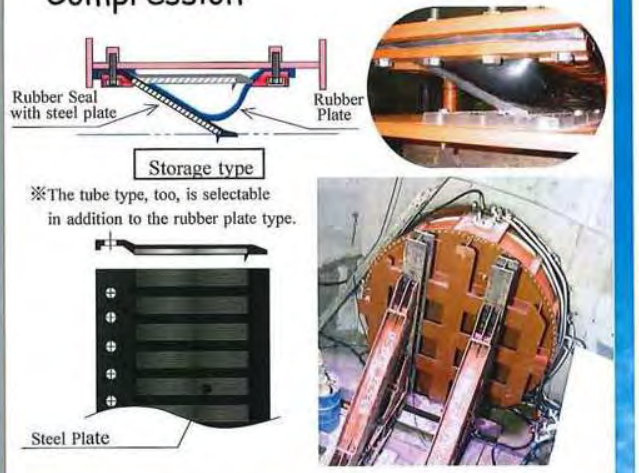
Type-B For Arrival of TBM

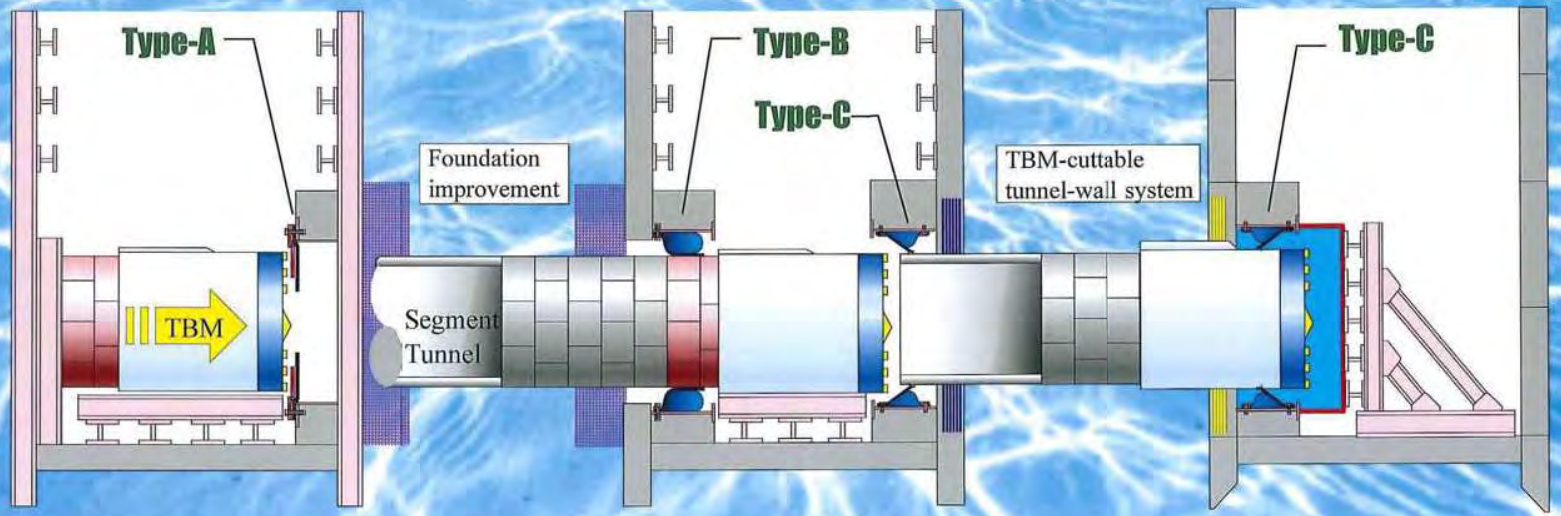
Breakthrough



Type-C For Launch & Arrival of TBM

Compression



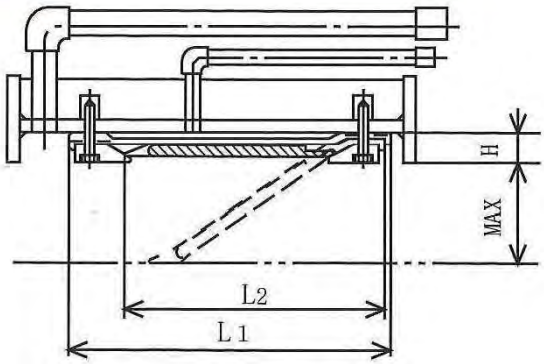


Variation of Main Body Shape

Flat-edge Shape

3D-edge Shape

TYPE-C Dimension-table



	Full length L1	Rubber Seal L2	Thickness H	Clearance Max
①	320	210	30	80
②	360	280	35	125
③	430	356	40	185
④	550	458	50	240
⑤	660	545	50	300

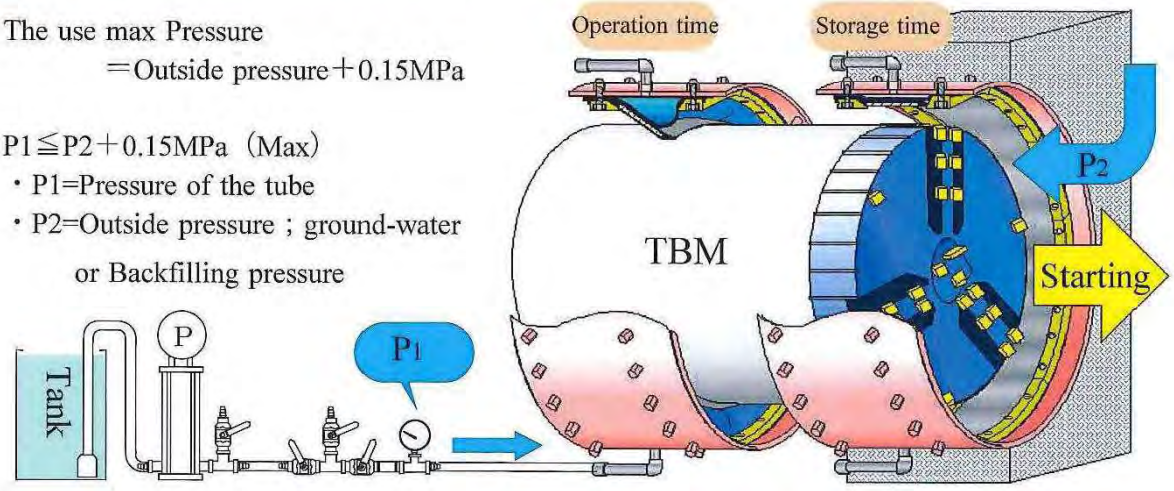
／mm

TYPE-C Instruction of the seal operation

The use max Pressure
＝Outside pressure＋0.15MPa

P1≦P2＋0.15MPa（Max）

- P1=Pressure of the tube
- P2=Outside pressure ; ground-water or Backfilling pressure



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Design & Manufacture
MUTSUBISHI RUBBER CO.,LTD.

HEXA SEALS

Continuous Casting Equipment

Roll Neck Seals TD Seals

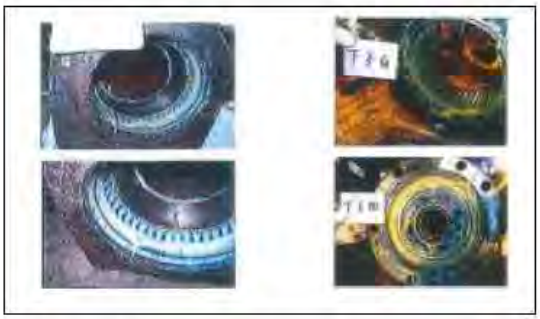
Mutsubishi Rubber Co., Ltd.

MUTSUBISHI RUBBER CO., LTD.

After Reconstructing

T Company

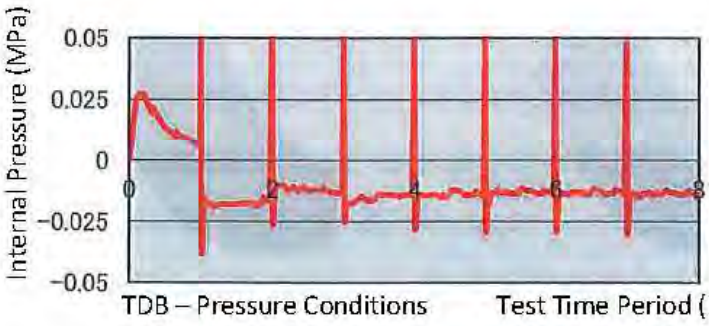
N Company



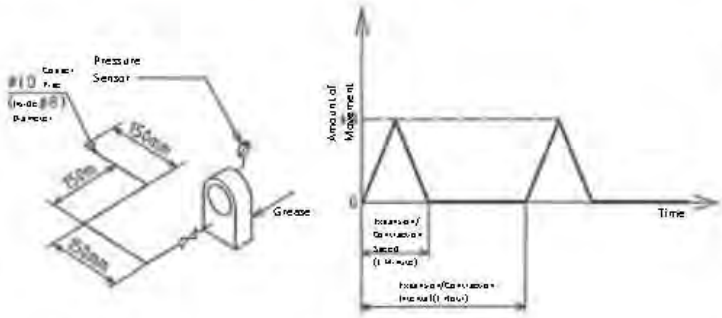
Grease quantity not a problem.
No grease discoloration.
The space between the Brg. rollers has been filled with grease giving it a high viscosity.

Grease filled / no discoloration
No moisture drippage

Test Conditions



Test Conditions



Chock Internal Pressure 1 Hour Change

Requirements

Shaft Diameter	: ø130
Temperature	: ~100°C
Time	: 8 Hours
Number of Rotations	: 5rpm
Amount of Shaft Movement: +3mm	
Grease Quantity	: 2cc/20 Minutes

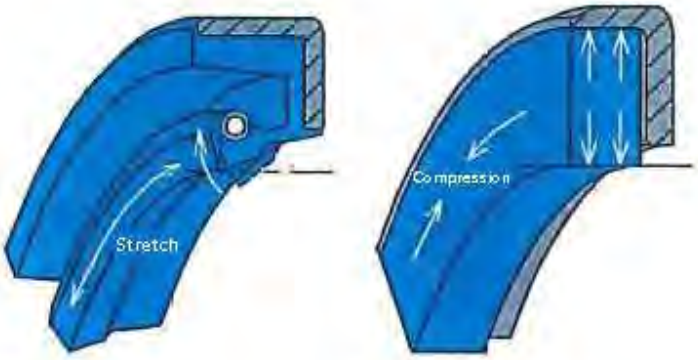
*Patent pending

Features

Lipless Compression-Type Surface Sealing Structure

1. Since lip-types are sealed by the tension of rubber, stretching will occur.

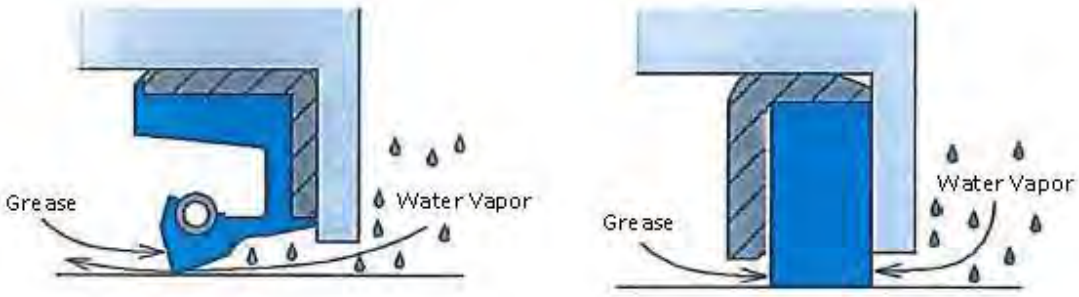
Since a TD seal has a large outer diameter which is brought into contact with the compression shaft, there is no occurrence of stretching so it does not easily crack.



Traditional Type New Type Format

2. Contact width is greater in comparison to traditional seals

- Improved dust resistance
- Prevents grease discharge
- Prevents water vapor intake



Traditional Type New Type Format

3. Can be used without reconstructing the current seal case.

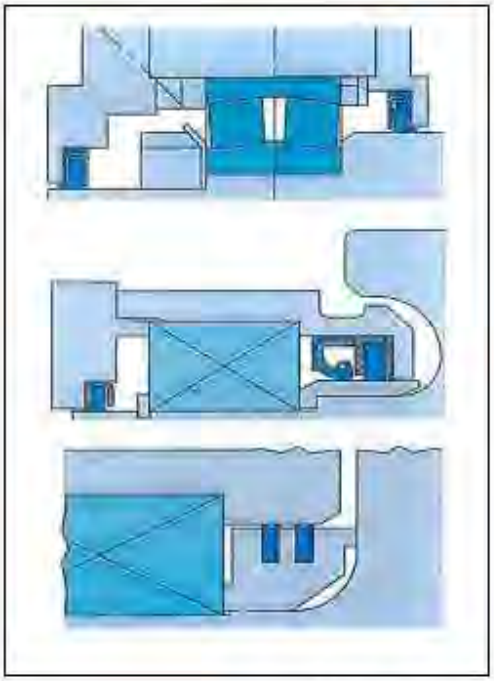
Examples) Oil seal type, piston ring type *Refer to Examples of Use 1-3

Examples of Use

Example of Use 1
Single Format
1 Neck: TDMC Type
2 Edge: TDMB Type

Example of Use 2
Double Format
3 Neck: TDYA Type
4 Edge: TDYB Type

Example of Use 3
Piston Ring Format
5: TDO Type



Type

TYPE	Cross-Section	Features	Back Pressure Retention Power
TDYA		Form with Interior Sliding Groove (For Pressure Relief)	0.03-0.5MPa
TDYB		Form without Interior Sliding Groove (For Pressure Retention)	0.9MPa +
TDYC		Form with Interior Sliding Groove + Check Valve (For Pressure Relief)	0.03-0.5MPa
TDO		Form with Exterior Sliding Groove (For Pressure Relief)	0.03-0.5MPa
TDOA		Form with Exterior Sliding Groove (For Pressure Relief)	0.03-0.5MPa
TDMA		Form with Interior Sliding Groove (For Pressure Relief) With Dust Seal	0.03-0.5MPa
TDMB		Form without Interior Sliding Groove (For Pressure Retention) With Dust Seal	0.9MPa +
TDMC		Form with Interior Sliding Groove + Check Valve (For Pressure Relief) With Dust Seal	0.03-0.5MPa

CIVIL ENGINEERING WORKS PLANT
ENVIRONMENT RELATED EQUIPMENTS DESIGN
PRODUCTION & DISTRIBUTION

Shield tunneling

COMPANY PROFILE
SAGAMI SERVO

Sagami Servo Co., Ltd has been involving in tail grouting, slurry materials grouting systems, foam injection system, surplus soil solidification facility, grouting pump & silo facility design, production & distribution mainly as civil engineering shield tunneling work facilities since its establishment on 1987. We not only propose the equipment facility, but also base on structuring its related general control system in regard to all kinds of requirements from our clients to propose the optimal solutions in various site environments. We are aiming toward building long-term trust relationship with our clients & expanding integrity business operations.

Company Name

Sagami Servo Co., Ltd.
Location: 3-31-14 Onodai, Minami-ku, Sagamihara, Kanagawa 2520331 Japan
Tel No: +81-(0)42-757-2670
Fax No: +81-(0)42-757-2361
Representative: Ishii Takao
Establishment: 18th Nov, 1987
Employees No: 10 persons (as on Jan 2012)

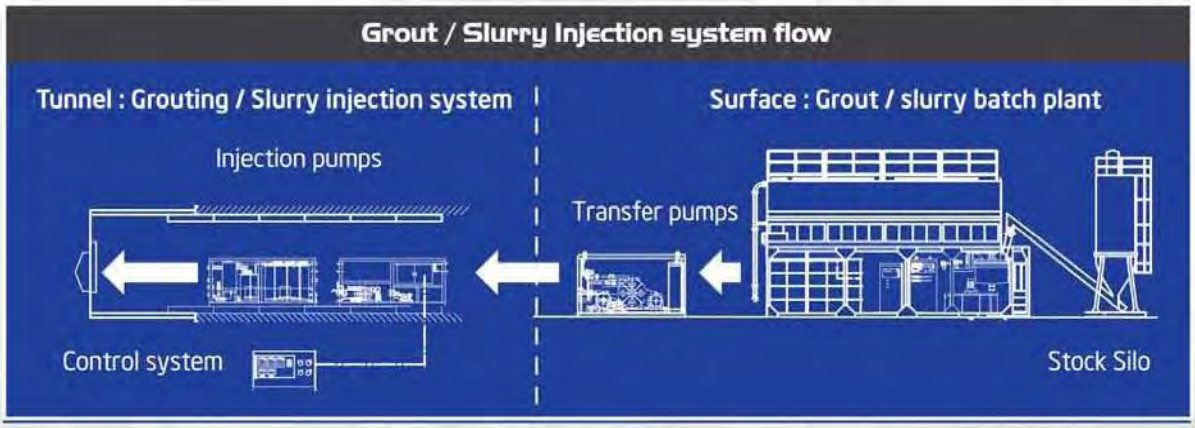
Business Contents

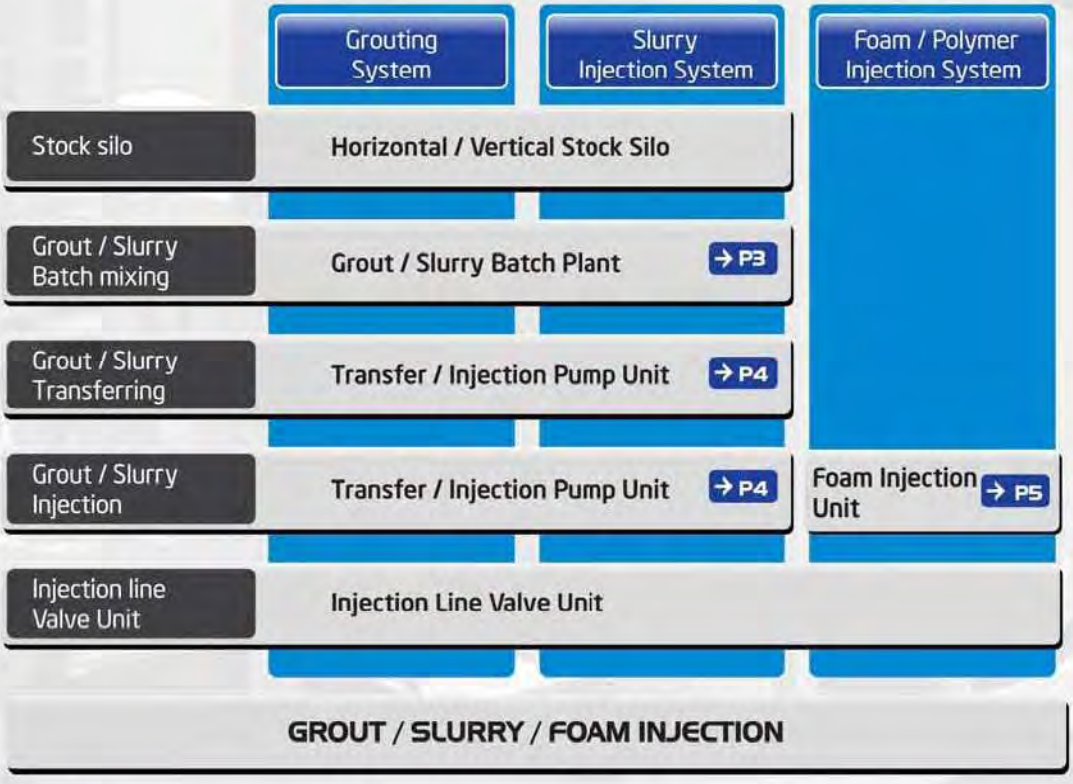
- Civil engineering works plant & environment related equipments design, production & distribution
- Shield tunneling work facility
- Grouting & Slurry injection systems
- Foam injection system
- Surplus soil solidification facility
- Grouting pump individual distribution
- Silo facility
- Environment related equipment facility
- Chimney decontaminant (cleaning)
- Other related equipments, parts distribution

Grouting, Mud slurry Grouting & Foam Injection Processes in Shield Work (Grouting / Injection Process)

The grouting, mud slurry grouting & foam injection systems in shield work mainly consist of the facilities below, by combining these facilities freely, we cleared various construction conditions in the sites of large diameter tunnel, multi-system injection & simultaneous injection etc.

Our company not only consistently supplying the facilities from materials stocking to each material injection management, but also proposing these facilities related general & flexible control system to optimize the injection related construction & management on site.





Optimal control system is proposed under various environment construction

Grout / Slurry Batch Plant

RS-50T

Its $3m^3$ grout / slurry batch per time is suitable for large capacity grouting, slurry batch mixing.
As the water tank & chemical are built in, space can be saved & tank arrangement is unnecessary.

RS-20T

With a horizontal silo, it can be installed at a place where space & height are restricted.
As all of the necessary material tanks for grouting, slurry materials are mounted, grout / slurry batch is available after installation.

RS-7B

As it is a space saving type, it can be installed at various locations.

RS Compact Batch Plant

With a horizontal silo, it can be installed at a place where space & height are restricted.
As all of the necessary material tanks for grouting, slurry materials are mounted, grout / slurry batch is available after installation.

Batch Plant Type	Mixing Capacity	Tank Stock	Material Tank (Build in)
RS-50T	$3m^3$ / 792gal	Up to 20m3 / 5283 gal	Water Tank, Chemical Tank
RS-20T with horizontal silo	$1m^3$ / 264gal	1.7 to $2m^3$ 449 to 528 gal	Powder Silo x 2, Water Tank Chemical Tank, Accelerator Tank
RS-7B	$1m^3$ / 264gal	1.7 to $2m^3$ 449 to 528 gal	—
RS Compact BatchPlant	$0.3m^3$ / 79gal	0.6m3 / 158gal	Powder Hopper x 1 Water Tank, Chemical Tank

Pressure Feed & Injection Pump Facility (Pump Equipment)

Pressure feed & injection pump T series has a simple structure & easy maintenance. It suitable for the pressure feed of grouting & mud slurry material from ground to pit & injection from pit. On top of that, it is a multi-purpose pump which can be used for pit drainage etc & fluid long distance transferring etc.

Injection Pump

T-85

T-65

T-32

Pump Type	Pumping capacity per minute (At no pressure)	Motor Output kw	Discharge Pressure bar / psi	Suction Pressure bar / psi	Weight kg
T - 85	240L / 63gal	15	15 / 217	-1/-14.5	950
T - 65	140L / 36gal	11	15 / 217	-1/-14.5	650
T - 50	50L / 13gal	5.5	15 / 217	-1/-14.5	550
T - 32	20L / 5.2gal	2.2	15 / 217	-1/-14.5	240
T - 25	10L / 2.6gal	0.75	15 / 217	-1/-14.5	180

Foam Injection Facility

Due to the raising of environment awareness, foam injection in shield work has attracted much attention. By selecting between pump foam injection & compressor & air managing equipment combined flow control injection in respond to the condition, our foam injection system meets the requirements of deep digging & multi-system injection etc.

P (Foam Pumping) Type Injection System

Injection pressure : Up to 15 bar
(Up to pumping capacity)

Component :

- Foam Injection Pump
- Foam Liquid Injection Pump
- Foam Agent Pump
- Pump Starter Panel
- Stock Tank
- Stock Level Control
- Foaming pipe
- Injection Control Panel

F (Foam Control) Type Injection System

Injection pressure : Up to 9 bar
(Up to compressor pressure capacity)

Component :

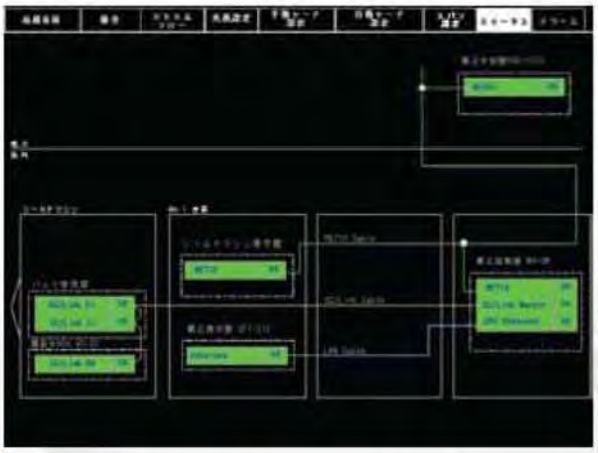
- Foam Liquid Injection Pump
- Foam Agent Pump
- Pump Starter Panel
- Stock Tank
- Stock Level Control
- Foaming pipe
- Injection Control Panel
- Air Compressor (Option)

Control System

Our company proposes a grouting & mud slurry grouting management related general control system.

- **Silo start-up panel**
- **Slurry batch plant managing panel**
- **Pressure feed pump start-up panel**
- **Injection pump start-up panel**
- **Injection line valve managing panel**
- **Injection control panel**
- **Monitoring system**
- **Signals communication with ground & pit other contractors' facilities**

Grouting control



Communication monitoring

Projects

North America

Northeast Interceptor Sewer - Los Angeles, CA
Beacon Hill Tunnel and Station Light Rail - Seattle, WA
North Shore Connector - Pittsburgh, PA
Queens Bored Tunnels East Side Access - New York, NY
University Link Light Rail - Seattle, WA
Alaskan Way Viaduct SR99 - Seattle, WA

Europe

Dockland Light Railway - London, UK
Channel Tunnel Rail Link - London, UK
Dublin Port Tunnel - Dublin, Ireland
Sofia Metro - Sofia, Bulgaria
Bosphorus Marmaray - Istanbul, Turkey

Oceania

Gold Coast Desalination Alliance - Gold Coast, QLD, Australia
Blue Water Desalination - Sydney, NSW, Australia
Northern Sewerage - Melbourne, VIC, Australia
Melbourne Main Sewer Replacement - Melbourne, VIC, Australia
Melbourne Desalination Plant Wonthaggi - Melbourne, VIC, Australia
Sydney Cable Tunnel - Sydney, NSW, Australia

Asia

Shanghai Roal Tunnel - Shanghai, China
Bangkok MRT Metro - Bangkok, Thailand
Singapore MRT Metro - Singapore, Singapore
Beijing Metro - Beijing, China
Taiwan Rapid Transit - Taiwan
Delhi Metro - Delhi, India
Bangalore Metro - Bangalore, India

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SAGAMI SERVO Co., Ltd

Shin-Tomoe Electric Manufacturing Co., Ltd.

Industrial Vehicle Department

Shin - Tomoe Electric Manufacturing Co., Ltd.

[Company Profile]

Gotenba Plant

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TEL 0550 (80) 2225　FAX 0550 (80) 2205

Industrial Vehicle Department

6-28-6, Minamiohi, Shinagawa-ku, Tokyo

TEL 03 (3762) 3117　FAX 03 (3763) 8601

http : // WWW . S - tomoedenki . co . jp /

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◗We Manufacture Conveying Vehicles and Equipment for Industrial Applications◖

Our products are compatible with electricity supplies up to 750 VDC 100 kW to meet the needs of customers.

We can use DC power to transport heavy materials. We can use AC power for various systems.

We provide made-to-order products that meet the needs of customers.
For example, a variety of power sources are available,
including batteries, external power sources (through trolley, cable, or wire, etc.), non-contact power sources and portable power generators
to respond to all working conditions.
A variety of engines are also available.
For example, motors are installed on the body, while winches are installed on the exterior.

Our original high-friction wheel can withstand higher driving and braking forces than a forged wheel or a cast wheel.
Because of our extensive expertise, our equipment can easily travel and stop at curves, which is generally difficult when transporting heavy loads
We offer high levels of operability as well as safety in the working environment.

[Sales Items]
The products we design and produce are generally divided into the following:

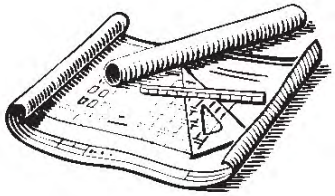
- Production equipment
  - Automotive vehicle
    - General conveying vehicle *See page 4.
      - Vehicle fitted for rails
      - Vehicle fitted with tires
      - Low lift
      - Towing car
    - System conveying vehicle *See page 5.
      - AGV (automatic guided vehicle fitted with tires)
      - RGV (automatic guided vehicle fitted for rails)
    - All-direction conveying vehicle fitted with tires *See page 6.
      - Wheel lift
      - 4-way truck
  - Trailer *See page 7.
    - Trailers fitted for rails
    - Trailers fitted with tires
  - Others *See page 7.
    - Voltage converter Fork De 100
- Railroad field *See page 8.
  - Auxiliary vehicles
    - Shunting vehicle
    - Road-rail vehicle
    - Battery-powered rail motorcar
    - Temporary truck (self-propelled and towed)
    - Coupling drill vehicle
    - Road floor washing vehicle
  - Others
    - Turntable
- Others *See page 9.
  - Battery locomotive
  - Sightseeing train in a tunnel
  - Monorails
  - Electric locomotives for construction work (battery powered locomotives) and various types of truck for construction work

Shin-Tomoe Electric Manufacturing manufactures a wide variety of products to meet the needs of customers.

Business Approach of Shin-Tomoe

Sale

Development and design



Production

Inspection

Field adjustment

Maintenance

We Respond to Your Needs with Safe Made-to-order Products

We Provide Customers with Our Products Through an Integrated Manufacturing Process

General conveying vehicles

● Vehicles fitted for rails●

We manufacture vehicles fitted for rails capable of carrying a wide range of loads from lightweight materials to 400-ton heavy materials.
Our equipment is designed for a wide range of rail gauges, from track gauge to the original gauge of a customer.
We have various types of brake for making emergency stops, including conventional electromagnetic brakes, emergency brakes in the event of a power outage, and track brake to make an emergency stop when coasting. A variety of safety functions that stop vehicles reliably are available for customers to select.

● Vehicle fitted with tires●

We manufacture vehicles fitted with tires capable of carrying a wide range of loads from lightweight materials to heavy materials weighing 50 tons.
We can provide a variety of operating modes from wireless and wired pendant control to onboard operation.
We also manufacture vehicles with various specifications for different speeds and inclinations, and in different sizes to meet the needs of the production equipment of a customer.

● Low lift ●

We manufacture low lifts capable of carrying a wide range of loads from lightweight materials to heavy materials weighing 45 tons.
The frame and pedestal itself are designed to move.
We also manufacture lifts that meet the needs of the production equipment of a customer.

● Towing car ●

We manufacture trailers fitted with tires and vehicles fitted for rails capable of towing a wide range of vehicle weights from lightweight vehicles to 100-ton heavy vehicles and from lightweight vehicles to 300-ton heavy vehicles, respectively.
We also manufacture equipment that meets the needs of the production equipment of a customer.

Vehicle conveying system

● AGV (automatic guided vehicle fitted with

We manufacture trucks fitted with tires capable of carrying a wide range of loads from lightweight materials to heavy materials weighing 50 tons.
Our equipment features a high stopping precision of ±10 mm when carrying heavy materials.
Guidance methods that match the equipment of a customer are available, with magnetic guidance (buried magnetic bars or magnetic tapes) being the main method.
We offer a variety of charging methods, including automatic charging, manual charging, and non-contact charging, that match the equipment environment of a customer.
We can also equip our vehicles with conveyors, push-pull devices, and other relocation equipment as required.
When a customer needs to move materials vertically, we can install a lifter to an AGV.
We can provide AGVs alone or design an AGV system, such as one that receives signals from upstream equipment, carries out operations, and sends signals to downstream equipment, to meet the needs of the production equipment of a customer.

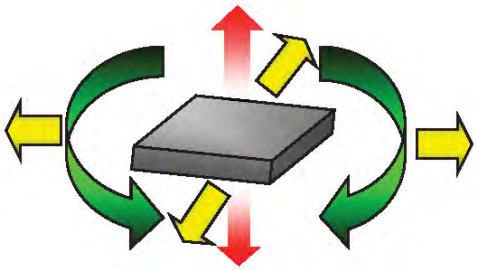
● RGV (automatic guided vehicle fitted for rails)

We manufacture RGVs capable of conveying a wide range of loads from lightweight materials to heavy materials weighing 400 tons.
Our machines feature a high stopping precision of ± 25 mm when conveying heavy materials.
Our machines use various tags to detect the correct stopping position.
We have various types of brake for making emergency stops, including conventional electromagnetic brakes, emergency brakes in the event of a power outage, and track brake to make an emergency stop when coasting. A variety of safety functions that stop vehicles reliably are available for customers to select.
We offer a variety of power sources that meet the needs of the equipment environment of a customer, including batteries, trolley power supply, cable power supply, portable power generators, and a series of hybrid systems composed of portable power generator and battery.
When a battery is used as a power source, we offer a variety of charging methods, including automatic charging, manual charging, and non-contact charging, that match the equipment environment of a customer.
We can also equip our vehicles with conveyors, push-pull devices, and other relocation equipment as required.
When a customer needs to move material vertically, we can install a lifter to an RGV.
We can provide AGVs alone or design an AGV system, such as one that receives signals from upstream equipment, carries out operations, and sends signals to downstream equipment, to meet the needs of the production equipment of a customer.

All-direction traveling vehicle fitted with tires

● Four-way truck ●

We manufacture vehicles capable of carrying a wide range of loads from materials weighing 1 to 30 tons.
Our vehicles are operated by wireless or wired pendant control.
Our vehicles are capable of moving forward and reverse, left and right, and diagonally, and turning 360 degrees, which is useful at various locations.
We produce four-way trucks with conveying capacities for loads of different weights as part of production equipment.



● Wheel lift ●

Our wheel lifts are designed to be capable of carrying materials weighing from 45 tons to 127 tons. They are operated by wireless pendant control.
Our trucks are capable of moving forward and reverse, left and right, and diagonally, and 360 degrees, which is useful at various locations.
Up to three lifts can be connected by wire and operated synchronously as a single system.
Our lifts are available as collective and discrete units of a production system.

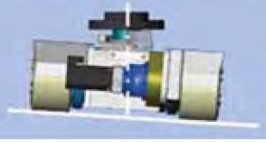
Innovative Wheel Module

The wheel module is fitted with a servo motor at each of the two wheels.
This makes the module low-slung and capable of traveling flexibly.

The wheel module is equipped with an elevating cylinder.
It is capable of traveling laterally when lifting a heavy load or on an upslope or a downslope.
*The limit value varies depending on the model. Please contact us for details.

Centerline

The shaft of the wheel module is capable of following a slope of ± 4˚.



Products Related to Production Equipment - Trailers

Trailers fitted with tires
Trailers fitted for rails

We manufacture trailers fitted with tires and vehicles fitted for rails capable of towing a wide range of loads, from lightweight vehicles to 20-ton heavy vehicles and from lightweight vehicles to 300-ton heavy vehicles, respectively. We also manufacture equipment that meets the needs of the production equipment of a customer.

* Note that this equipment is not allowed to travel on public roads.

Products Related to Production Equipment - Others

We produce a variety of equipment developed to meet the needs of a customer.
They are useful when carrying out repairs and maintenance.

48 V Voltage Converter for Lead Battery

Fork De 100

◆ **Rechargeable LED light** ◆

NEW ST Light
NSTL-9.6LH

Railroad Field - Auxiliary

We manufacture maintenance vehicles for use in rail yards and marshaling yards and on train tracks after the last train has stopped operating. A great advantage of our machines is their quiet and clean motors, which help reduce noise that affects neighbors, reduce noise during train operations late at night, and keep the working environment at rail yards and marshaling yard clean.

Railroad Field - Others

● Turntables ●

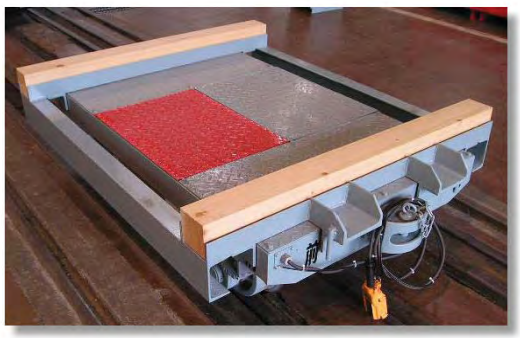
We manufacture a variety of made-to-order machines, including turntables for changing the traveling direction of a rail vehicle.

Others

● Various Vehicles for Various Purposes ●

● Electric locomotives (battery locomotives) for construction work ●

● Vehicles for construction work ●



Some Major Customers

IHI Corporation
IHI Transport Machinery Co.,Ltd.
AISIN KEIKINZOKU Co.,Ltd.
Aisin Seiki Co., Ltd.
Akatani Kosan Co.,Ltd.
Asahi Kasei Corp.
Azuma Co,LTD
Ashio Copper Mine Tourist Management Office
ISUZU BODY CORPORATION
Ittetsu Iron Works, Co., Ltd.
Ina city office
Iwate Medical University Hospital
H-ONE CO., LTD.
MHI Sagami High-tech LTD.
Oita Mining Co., Ltd.
OSAKA STEEL CO., LTD
OSAKA Titanium technologies Co.,Ltd.
Okamoto Machine Tool Works,Ltd.
Ono Kikai Seisakusho Co., Ltd.
Ochiai Co., Ltd.
Orii Corporation
Oji Yuka Synthetic Paper Co.Ltd
Ozawa Machinery Co., Ltd.
Kasuga Paper Industry Co., Ltd.
KAWAGISHI BRIDGE WORKS CO.,LTD.
Kawasaki Heavy Industries, Ltd.
Kanto Special Steel Works, Ltd.
KAWAGISHI BRIDGE WORKS CO.,LTD.
KAWAGUCHI METAL INDUSTRIES CO.,LTD.
The Kansai Electric Power Company,Incorporated
KYOWA LIMITED
Kirin Brewery Company, Limited
Kyoto Tea Cooperative
JAPAN EXPO YAMAGUCHI 2001
Caterpillar Japan Ltd.)
KUSHIRO COAL MINE CO.,LTD.
Koganezawa Mine Co., Ltd.
Kochi Prefectural Police Aviation Unit
Sano Denki Co., Ltd.
SAN-ETSU METALS Co.,Ltd.
JFE Steel Corporation
JFE MINERAL COMPANY,LTD.
Shirakawa Co.,Ltd.
Showa Aircraft Industry Co., Ltd.
Shin-Etsu Chemical Co., Ltd.
Suehiro Technology Institute Co.
STANLEY ELECTRIC CO., LTD.
Nippon Steel & Sumikin Metal Products Co.,Ltd.
SUMITOMO(S.H.I.)CONSTRUCTION MACHINERY CO.,LTD.
Suehiro Technology Institute Co.
Sendai Coast Guard Headquarters
TDF CORPORATION
Daido Steel Co., Ltd.
PACIFIC METALS CO.,LTD.
TAKAOKA ELECTRIC MFG.CO., LTD.
TADANO LTD.
Daito Electric Co., Ltd.
DAIHATSU MOTOR CO., LTD.
Yamato Kogyo Co., Ltd.
TANABE CORPORATION
Chugoku Lumber Co., Ltd.
Teine Keijinkai Hospital
Tokyo Kikai Seisakusho, Ltd.
TOSHIBA CORPORATION
Joban Kosan,.Ltd.
Isuzu Motors Limited
Tokyo Kikai Seisakusho, Ltd.
Tokyo Kiko Ltd.
Tokyo Tungsten Co. Ltd.
Southeast Botanical Gardens
Tomoegumi Iron Works Co., Ltd.
Topre Saitama Corporation
TOPPAN PRINTING CO., LTD.
Tomijima Unyu Co.,Ltd
Tokushima Prefectural Police Aviation Unit
Dokkyo Medical University Hospital
Toyota Motor East Japan, Inc.
NISHIMURA WORKS CO.,LTD.
NITCHITSU CO.,LTD.
NISSAN SHATAI CO., LTD.
Nippon Metal Industry Co., Ltd.
NKK Corp.
NIPPON PAPER PAPYLIA CO.,LTD.
Nippon Electric Glass Co., Ltd.
Nippon Yakin Kogyo Co., Ltd.
NIPPON PLASTIC PALLET CORPORATION
Japan Highway Public Corporation
The Japan Atomic Power Company
JAPAN NUCLEAR FUEL LIMITED
NISSEI PLASTIC INDUSTRIAL CO., LTD.
Nippon Steel & Sumikin Welding Co., Ltd.
Hakko Sangyo Co., Ltd
The Hanshin Diesel Works, Ltd.
PS Co.,Ltd
Hitachi, Ltd.
Hitachi Chemical Company, Ltd.
Hitachi Construction Machinery Co., Ltd.
Hitachi Cable, Ltd.
Lakewood Cooparation
Fujisawa Steel Co.,Ltd.
Fujita Corporation
Fujinetsuren Industry Co.,Ltd.
FUJIMI KOKEN CO.,Ltd
Fuji Heavy Industries Ltd.
Honda Motor Co., Ltd.
Honshu Paper Co., Ltd.
MATSUO ERIDGE CO., LTD
Matsushita Electron Co., Ltd.
Marusumi Paper Co., Ltd.
Mazda Motor Corporation
Miyano Co., Ltd.
Mitsubishi Motors Corporation
Mitsubishi Heavy Industries, Ltd.
Mitsubishi Paper Mills Ltd.
Mitsubishi Logistics Corporation
Mitsubishi Electric Corporation
Mitsubishi Petrochemical Co., Ltd.
MIYAJI IRON WORKS CO., LTD.
MITSUI MEEHANITE METAL CO.,LTD.
Mitsui Chemicals Tohcello, Inc.
Miyazaki Prefectural Police Aviation Unit
Metal One Steel Service Corporation
MORINAGA&CO.,LTD.
YASUDA-KOKI co.,ltd.
Yachiyo Industry Co., Ltd.
Clean Metals Co., Ltd.
Yukishima Iron Works, Co., Ltd.
UNIPRES CORPORATION
YOKOMORI MFG.CO., LTD.
Yodogawa Steel Works, Ltd.
Yoshizawa Lime Industry Co.,Ltd.
YONETANI DIE & MOLD CO.,LTD.
Rengo Co., Ltd.

Railroad field

Railway Technical Research Institute(RTRI)
Hokkaido Railway Company
East Japan Railway Company
Central Japan Railway Company
West Japan Railway Company
Japan Freight Railway Company
JR Techno Service Sendai Company
Bureau of Transportation Tokyo Metropolitan Government (Toei Subway)
Tokyo Metro Co., Ltd.
Transportation Bureau, City of Yokohama
Kobe Municipal Transportation Bureau
Fukuoka City Transportation Bureau
TOKYU CORPORATION
Odakyu Electric Railway Co., Ltd.
Keikyu Corporation
Hankyu Corporation
SAGAMI RAILWAY Co., Ltd.
LTA Singapore
Seoul Metropolitan Rapid Transit Corporation

TOMOE

We are dedicated to researching and developing environmentally friendly, safe, and efficient products.

Shin-Tomoe Electric Manufacturing Co., Ltd.

http://www.s-tomoedenki.co.jp/

Industrial Vehicles

We are actively engaged in developing and manufacturing automatic guided transportation systems for plants and factories. The various obstacles in a plant include electric cables, rails, water, and oil. In addition, conveying materials also vary by form and weight.
We are dedicated to providing the capability of conveying various materials safely and rapidly under a wide range of conditions. We apply our technical expertise, which is a strong competitive advantage, to achieve truly safe and workable automatic guided transportation systems.


Conveyance system


AGV/RGV


Tire carts


Rail carts


Battery railroad auxiliary vehicles


Road-rail vehicle

Construction Vehicles

Conveyance systems required at major projects for tunnel construction, underground development, and urban redevelopment must be safe, efficient, and low-cost, yet environmentally friendly.
Shin-Tomoe Electric Manufacturing generally asks clients to involve us in the early planning stage of a project so that we can integrate the process of design and production to provide the clients with the best solutions.


Servo locomotive (small)


Servo locomotive (medium size)


Servo locomotive (large)


Pin rack type servo locomotive (small to large)


Rental vehicle


Hybrid vehicle

TOMOE

Profile of Shin-Tomoe

With accumulated expertise and experience producing electric vehicles, Shin-Tomoe Electric Manufacturing Co., Ltd. is a manufacturer of battery-driven special conveyor vehicles. We are actively engaged in developing and maintaining products designed to support current needs for environmental preservation and improving the efficiency of work.

In particular, our products are capable of satisfying a variety of specifications—manned, and unmanned and DC and AC—as well as a variety of modes of conveyance in various fields. Our R&D focus on hybrid vehicles and electric vehicles. We aim to meet demand for a wide range of machines and fields.

We also take pride in our quality control activities. Specifically, we maintain "ISO9001" certification to ensure the manufacture and maintenance of highly reliable products. We are committed to playing our social role as a venture-type corporation with high levels of technical expertise capable of quickly meeting various needs.

Corporate profile of Shin-Tomoe Electric Manufacturing Co., Ltd.

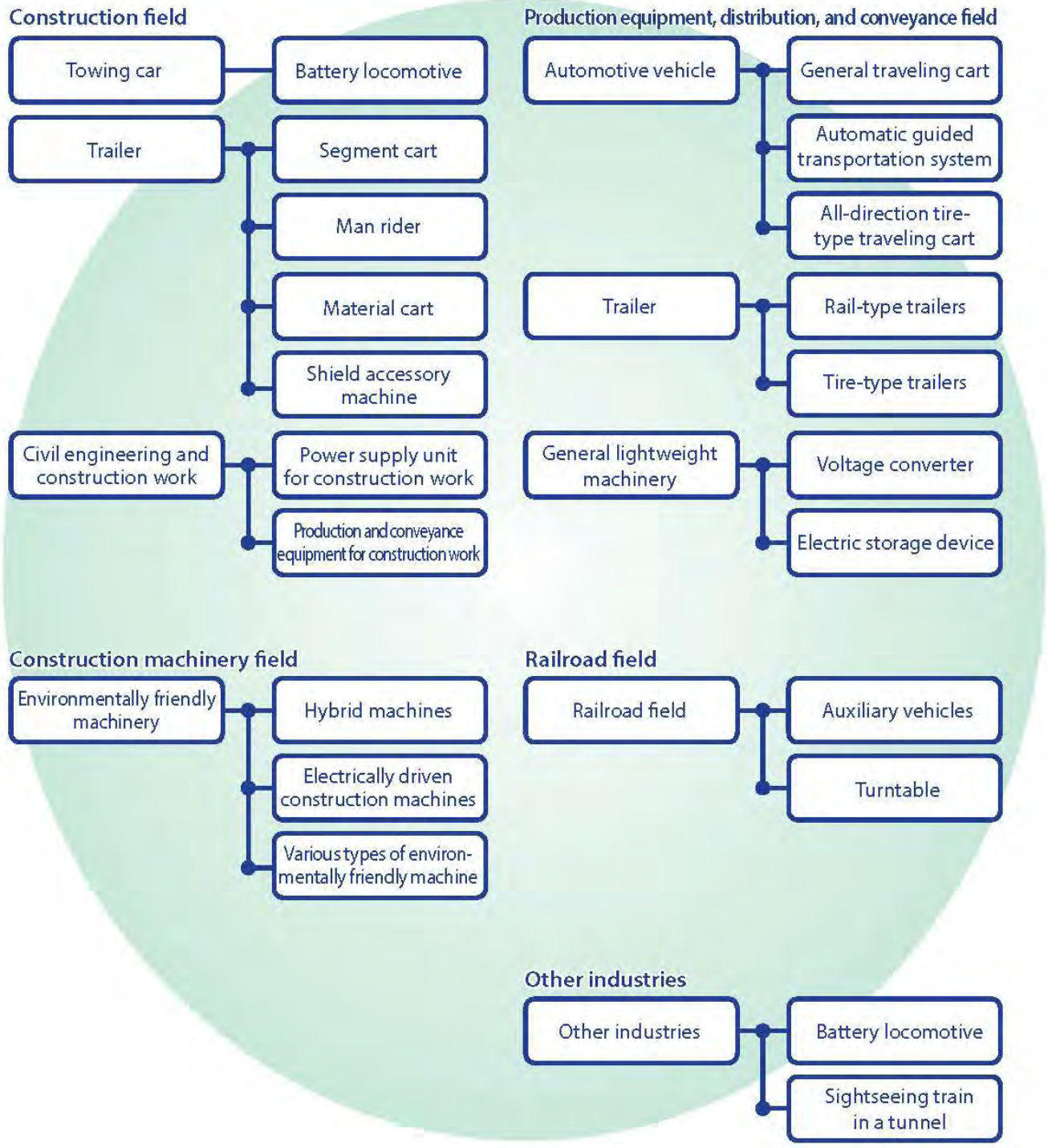
Company Name	Shin-Tomoe Electric Manufacturing Co., Ltd.
Office	Head office 6-28-6, Minamiohi, Shinagawa-ku, Tokyo 140-0013 Tel: 03-3762-3111 Fax: 03-3763-3761 Gotenba Plant Fuji Gotenba Industrial Park, 2314-3, Jinba Odori, Gotenba city, Shizuoka prefecture 412-0047 Tel: 0550-80-2225 Fax: 0550-80-2205 Osaka Office 3-4-8, Tokura, Toyonaka city, Osaka prefecture 561-0845 Tel: 06-6866-2321 Fax: 06-6867-5251
Capital	¥100,000,000
Stockholder	Nishio Rent All Co., Ltd. (financed 100%)
Directors	President Masashi Nishio (President of Nishio Rent All Co., Ltd.) Senior Managing Director Wataru Yamada Director Katsumi Odachi Director Yoshihiro Tonomura (Senior Managing Director of Nishio Rent All) Auditor Kazusou Nitta (Managing Director of Nishio Rent All)
Employees	73
Banks	Omori Branch, Mitsui Sumitomo Bank

ISO 9001

QUALITY ASSURANCE JC
REGISTERED ORGANIZATION
No.0868-ISO9001

MS JAB CM002

RvA C 086 MGMT. SYS.



TOMOE

Shin-Tomoe Electric Manufacturing Co., Ltd.

2014.7

Test Course

With our test course named "Fuji Technical Course" located at our factory, we can give our customers hands on experience with our equipment.

We strive to improve our service and productivity continuously. As always, we appreciate your continuing support for our activities.

Outline of "Fuji Technical Course"

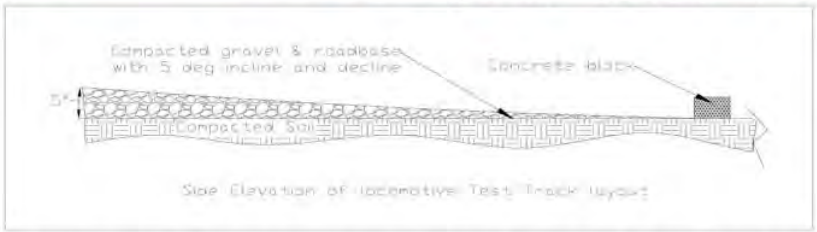
Overall Length	:	**Flat section - 30m / S lope section - 63.5m**
Angularity	:	**50/1000**
Max. Height	:	**3.325m**
Applicable Rail Gauge	:	**480mm (outward flange)**
		508mm
		762mm
		914mm
		1067mm
		1435mm
Rail Weight	:	**22kg**
Weight	:	**Haulage train (13t) + Test trolley (20t)**
Width	:	**2700mm (RG1435)**

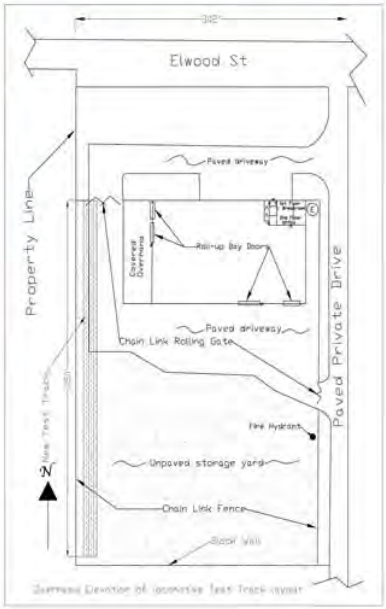
*** This test course is also available for test run of "Pin Rack Servo Locomotives"**

Establishment of Test Course Phoenix, Arizona USA

Gomez International, Inc., located at 1415 E Elwood Street, Phoenix, Arizona 85040 USA is Shin-Tomoe's Sales and Service Representative in North, Central and South America. Offering our customers Expert Assistance and Service, Gomez International, Inc. is in the process of building a new Test Course. This new Test Course will be located at their Manufacturing/Rebuild facility in Phoenix, Arizona USA and will allow our customers to see first hand our products at work at a convient location within the United States.

We look forward to having Gomez International, Inc. provide our customers with the service and assistance we strive to provide.





Outline of Gomez International, Inc. Test Course

Overall Length	:	Flat section - 100 ft / Slope section - 250 ft
Angularity	:	50/1000
Max. Height	:	20 ft
Applicable Rail Gauge	:	36 inch gauge and/or 24 inch gauge
Rail Weight	:	72 lb
Width	:	10 ft

North, Central and South America Sales and Service Representative

FOR INFORMATION PLEASE CONTACT

PROCUREMENT SPECIALISTS
a Division of Gomez International, Inc.
1415 E. ELWOOD STREET
PHOENIX, ARIZONA 85040 USA

(620)268-9275 * (520)421-7165

GomezInternational.com
info@gomezinternational.com

Corporate Profile

STARLOY

Tunneling machine bits & roller cutters
Earth auger bits & slurry wall machine bits
Special boring machine heads & attachments

Ultra High Performance Cutter Bit STARLOY

http://www.starloy.com/

Management Concept

Build, dig, think.....

These mantras are the driving force of STARLOY's evolution.

As a specialized manufacture of roller cutters, cutter bits and other cutting tools, STARLOY produces innovative and versatile products. STARLOY creates customized products to meet your needs in the field. STARLOY has developed high quality products by using collected data and experience to produce products that have been chosen to be utilized in harsh environments throughout the world. STARLOY has developed the means to respond swiftly to the demands of our customers project schedules and continuously seeks to develop high quality, long service life, innovative and new manufacturing methods, products and processes, in our own factory, to accommodate our customers' needs. STARLOY also offers after-sales service and technical support.

1988
The Channel Tunnel

1994
Trans Tokyo Bay (aqua-line) Tunnel

2006
Hanshin Expressway Fushimi tunnel

2007
Dubai Metro Project

2010
Bosphorus Tunnel

These are examples of the construction projects STARLOY products were used. Our products have been used on projects throughout the world.

Company History

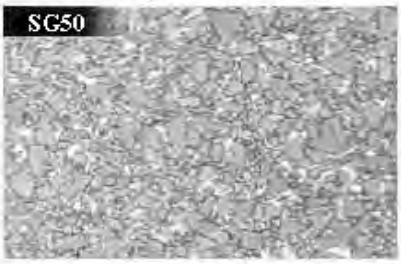
1927	Began business as metal-processing industry in Osaka
1945	Began cemented carbide processor
1966	Began cemented carbide production
1973	Relocated production basis in Komada-gun Okayama and established corporation STARLOY
1997	Relocated the main factory in Kumenancyo Okayama.

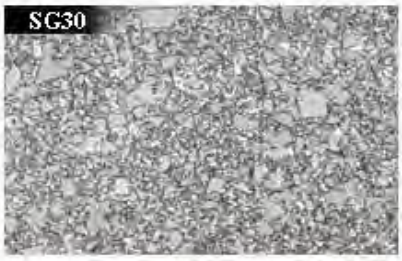
Manufacturing cemented carbide at its own factory, STARLOY provides high quality products with speed to meet the demands of project schedules.

Cemented Carbide STARLOY

Cemented carbide [STARLOY] contains tungsten carbide {(WC) normally 1 – 10 micron powder} and cobalt (CO) powder, sintered at high-temperature compression Sintered alloy is produced through a powder metallurgical process. The cobalt steel envelopes the tungsten carbide particles, shown in photos to the right. The cemented carbide, at ordinary temperatures not only has very high structural strength and hardness, but is also wear resistant, has high compression strength, is corrosion resistant, and maintains these characteristics at high temperatures which is required for cutting tools, rock drill bits and many other products. In recent years, with the improvement of manufacturing methods has resulted in higher quality product. The cemented carbide has been utilized in other fields where high abrasion and impact resistance is required. Through innovative developments in carbide alloy production, the toughness can be achieved without compromising hardness by adjusting parameters including tungsten carbide particle size, although the toughness was abandoned in order to enhance hardness in the past. STARLOY researches new varieties of alloy. Our continuing efforts towards product quality and product improvements and development is achieved with our own factory equipment and complete process control. STARLOY manufactures throughout from the standard products shown in table (in blue) to specialized products. Selection of the best option matched for your project, STARLOY believes that the reduction of frequent cutter replacement improves operating efficiency and will allow our customers to obtain a satisfactory and enhanced production results.

■**Carbide Alloy STARLOY Organization (x 1000)**



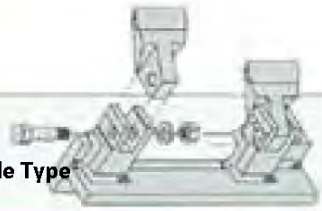


CUTTER BIT FOR TUNNEL BORING

Excavation performance of the Tunnel Boring Machine is dependent on the cutting efficiency. Our cutter bits were born from extensive field experience, and have excellent cutting performance.

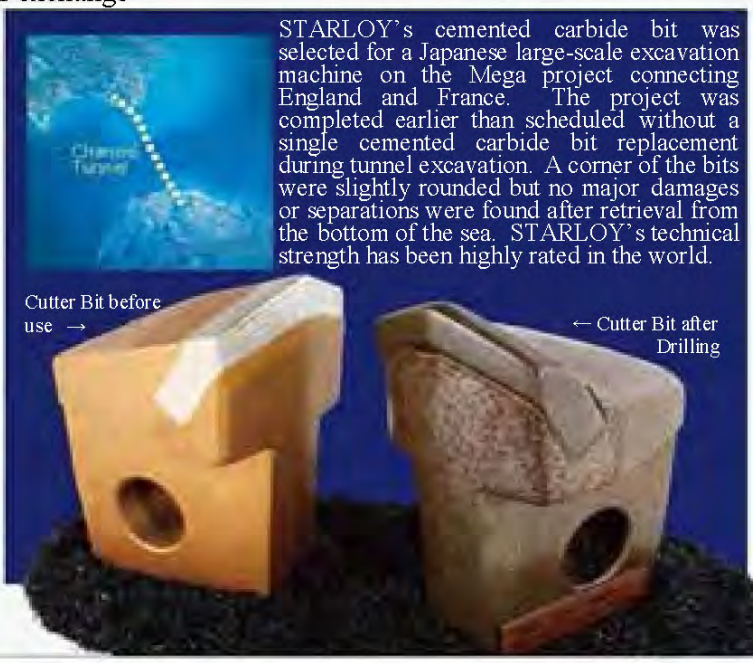
• Pin Bolt Mounting Type

A single bolt makes replacing the cutter bit easier and safe. Moveable type rear wear can be reduced with this application, it is advantageous when there is a lot of exchange



Pin-Bolt
Detachable Type

STARLOY's cutter bit had been adopted for Trans Tokyo Bay Aqua line, Dubai subway construction and more sites in the world.



STARLOY's cemented carbide bit was selected for a Japanese large-scale excavation machine on the Mega project connecting England and France. The project was completed earlier than scheduled without a single cemented carbide bit replacement during tunnel excavation. A corner of the bits were slightly rounded but no major damages or separations were found after retrieval from the bottom of the sea. STARLOY's technical strength has been highly rated in the world.

•Bolt Mounting Type

The cutter bit can be replaced by a bolt. It is a fixed type and is easier than the welded mounting type.

Roller Cutters

Roller Cutters are compatible with a variety of construction methods including Hard rock TBM and Mixed Face Shield TBM. Cutter ring hardness, in general, is the same throughout the ring. STARLOY uses a proprietary heat technique to make the cutting tip harder than the inside of the ring. This will provide high abrasion resistance with high impact resistance and maintain the inner toughness of the ring required for peak performance. The bearing chamber of the cutters have a special seal to allow lubricating oil to be placed inside. This will prevent the inflow of water under high underground water pressure. In addition, it has an automatic pressure compensator to adjust lubricating oil pressure equal to the external pressure that ensures the smooth rotation of the cutters.

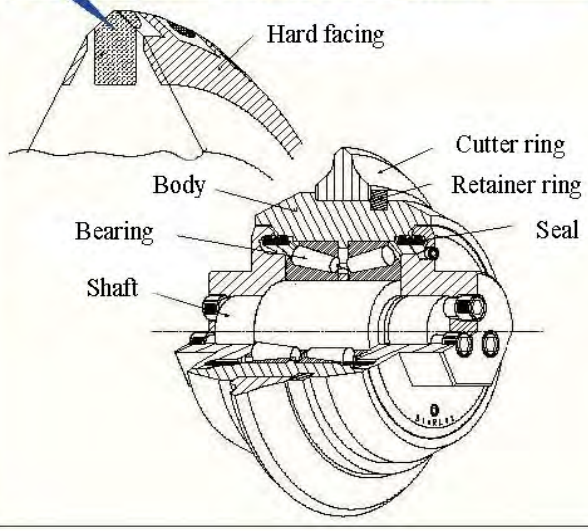
● Cemented Carbide Chip - Inserted Method

● Integrated Quenching Method

● Ring Exchangeable System

Cemented Carbide Chip Vacuum Insert Method

STARLOY uses a unique vacuum method to press Cemented carbide chip into the ring. It enhances the retention force and prevents peeling off during insertion of the chip. This is a technology developed by STARLOY



● Cemented Carbide Chip Insert Method

There are a wide variety of Roller Cutters corresponding to the various sites

Main Factory

- High Quality
- Streamlined manufacturing methods to meet demand
- Our Main Factory is the production base supporting both demands.

STARLOY Main Factory can assist from design through production and manufacturing to delivery. The factory possess numerous large and small production machines and testing equipment. In order to deliver the best quality to our customers in a timely manner, all equipment is continuously updated to the latest in the industry. Continuing efforts are made to enhance the technological information obtained from many years of production utilizing carbide, not only relying on the latest equipment, but through continued research and development.

STARLOY cutter bit manufacturing process

Unique Shank Base Structures using a special steel

STARLOY uses a special steel (SKC24) for the Shank Base to install Carbide Tip. The special steel (SKC24) is not available in the general market. STARLOY has a contract with a steel company who can provide small-lot production as a private manufacturer.

Features of Shank Base manufacturing using a special steel

High-quality heat treatment by vacuum quenching and tempering furnace will reduce heat stress during brazing of Carbide Tip installation. Shank Base material of the peripheral Carbide Tip will be re-quenched during brazing. For general steel, it will be a tempering state during brazing to become soft near the Carbide Tip where the most strength and hardness is required. As a result, the Shank Base causes early wear, deformation, and shortens the service life of the cutter bit. STARLOY's special steel has a property of further hardness when re-tempered, which makes the service life of the cutter bit longer.

Shank Base are machined on our own metal processing facilities.

Based on feedback from the cutter bit production site, we are flexible and can quickly manufacture the Shank Base in accordance with the shape and arrangement of the Carbide Tips

STARLOY

Vacuum and Pressurizing Sintering Furnace

Horizontal Machining Center

3D Measuring Instrument

•EQUIPMENT LIST

Horizontal Machining Center
Universal head type NC milling machine
Universal head type milling machine
Vertical machining centers
NC Lathe
Welder
Blast
Cylindrical grinding machine
Surface grinder
Side grinding machine
Hydraulic internal grinding machine
Hydraulic press
High-frequency devices
Electrical discharge machine
Vacuum sintering furnace
Vacuum and pressurized sintering furnace
3D measuring instrument
Shape measuring instrument
Surface roughness measuring instrument
Image measuring instrument
Rockwell hardness tester
Compression tester
Hydrometer
Metallurgical microscopes
Band Saw

Cutting Edge

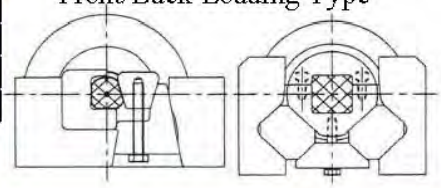
With a combination of various carbide tip and cutters in every scene, STARLOY demonstrates the highest level in performance with various Cemented chip and ring bodies. Hardness of cemented carbide chip, number, shape and ring body combination variations are endless. STARLOY will custom each product, one by one, from design to tailor fit the needs of the industry



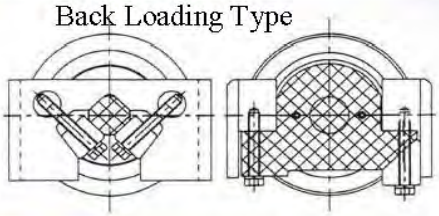
Type	Suppler	HRC	
		Cuttig Edge	Internal
SNCM (Standard)	Starloy	53-56	35-45
	Others	51-53	51-53
SKD (Enhanced Life)	Starloy	58-61	40-45
	Others	55-57	55-57

Various housing types are available

Front/Back Loading Type



Back Loading Type



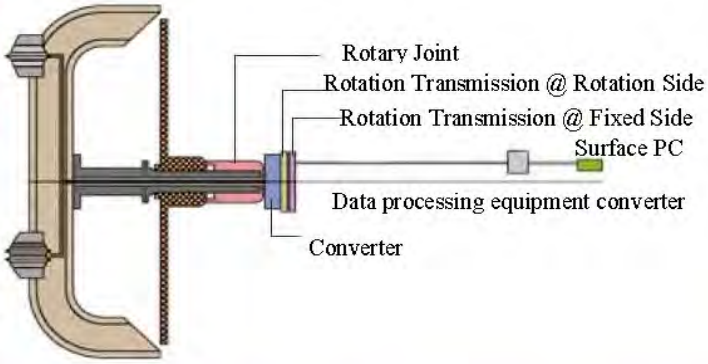
Roller Cutter Monitoring System

It is a real time monitoring system of Roller cutter conditions

Innovative cutting edge of monitoring and recording system for applied load on Roller cutter, cutting tip wear amount and rotation status by sensors.

Currently, TBM (Tunnel Boring Machine) method is increasingly diversified and expanding its application to the mixed face, long distance, deep and large section by the rationalization of the construction method and improving mechanical performance.

STARLOY developed Roller Cutter Monitoring System to monitor and record applied load on roller cutter, cutting tip wear amount and rotation status in real time. It will provide appropriate replacement of Roller cutters, TBM excavation efficiency and planned maintenance. (Available for Shield TBM.)



STARLOY

• Welded Type Cutter Bit

World focus on technology, condensed STARLOY's cutter bit. It can be installed as fixed type where welding space is available. A holder is unnecessary and simple installation delivers the advantage in terms of cost.

• Special Pre-Cutters

It became possible to lower cost, shorten delivery, increase quality and stability by streamlining the production with the forging dies using special steel material.

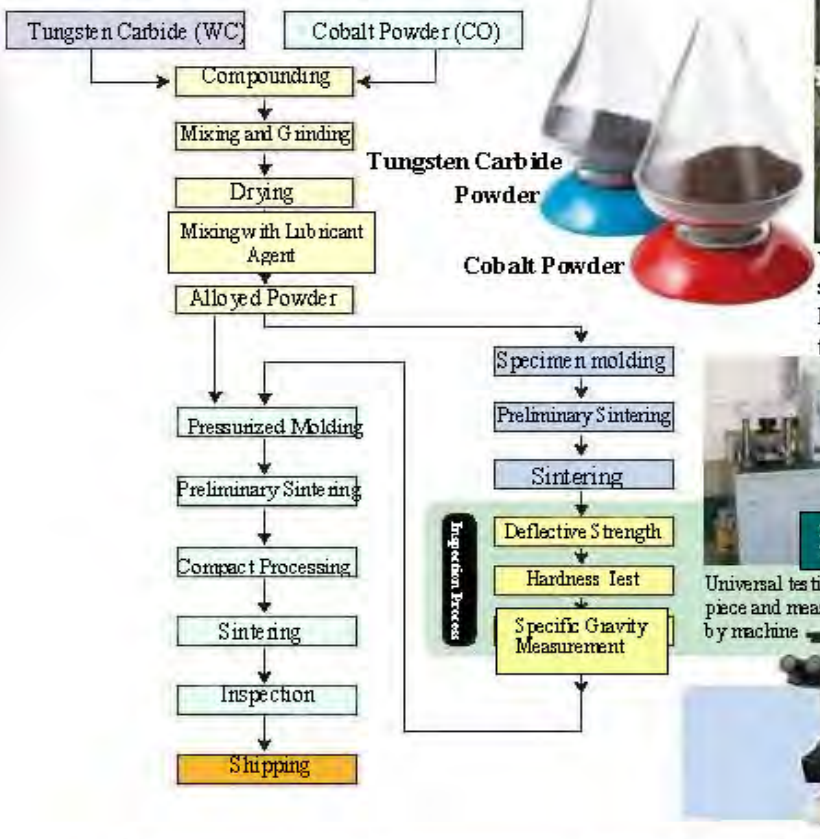
STARLOY stocks a wide variety of forging dies of the cutter bit. Large quantities of required products are also readily available.

• Constantly stocking appropriate steel for bits and roller

STARLOY uses special steel (SK24) on the base material Shank, which is installed on the cemented carbide tip. Strength, toughness and heat resistance, are currently considered as the best steel for longer operating life. Normally, it may not be able to meet sudden request due to order production; however, STARLOY keeps extra special steel in stock to supply customers' needs for rush orders.

Manufacturing process of Cemented carbide STARLOY

Extensive experience, accumulated data and our passion for new technology creates superior products.



Tungsten Carbide Powder

Cobalt Powder

Vacuum pressure sintering furnace

Vacuum Sintering Furnace

By making full use of high-precision, state-of-the-art testing equipment, the quality of microns are checked.

Deflective Strength Testing Machine

Universal testing to create a test piece and measure the breaking load by machine

Specific Gravity Testing

Hardness Testing

Measure the test piece with Rockwell Hardness Tester

Metallograph

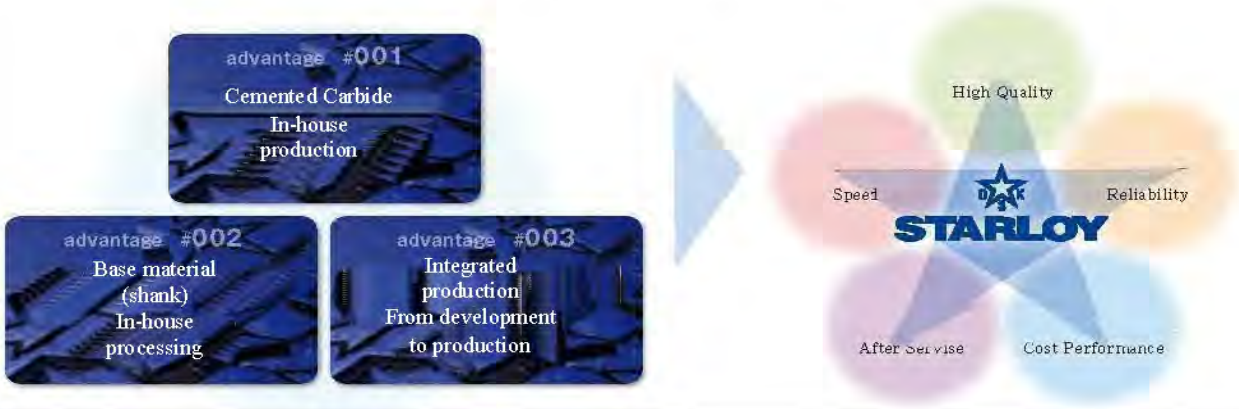
Microscope is used to check the metal structure

JIS			Symbol	Hardness HRA	Transverse rupture strength N/mm² (Kgf/mm²)	Fracture toughness (KIC) MPa·m1/2	Wear resistance (CCPA) CC/rev	Use(Bit)
Classification Symbol	Hardness HRA	Transverse rupture strength N/mm² (kgf/mm²)						
E2	89 more than	1373 or more (140)	SG2	89.5	2650(270)	13.1	7	For rock drilling machine For boring machine
E3	88 more	1569 or more (160	SG3	89	2740(280)	13.4	9	For turned boring machine For basic excavator For continuous wall construction
			SG3A	88.5	2840(290)	13.8	14	
			SH30	88	2940(300)	14.7	19	
E4	87 more	1667 or more (170)	SG40	87.5	2940(300)	15.4	24	
E5	86 more	1961 or more (200)	SH50	86.5	2940(300)	18.7	28	

STARLOY always utilizes optimum inspection and manufacturing processes to maintain greater quality and specifications. Specimens are kept for 5 years to track performance and quality of each alloy manufactured. This data is also used for quality improvement.

STARLOY responds to feedback quickly from customers in the field using our product. Studying the shape and thickness of the products from the condition of the hard bit which was used in the field helps in continuing advance in manufacturing.

STARLOY produces the highest quality product available, achieved through our strict inspection process and hundreds of the manufacturing hours at our main factory.
Manufacturing processes of the bits includes cemented carbide manufacturing, shank (base material) processing, hard facing, welding, brazing, assembly and finishing. By utilizing each particular factory and station for each process we have achieved the ability to meet customers' requirements, lower costs, and streamline production of our products. STARLOY resolved issues causing manufacturing delays by aggregating all processes in the main factory property and producing products in an integrated system. Speedy response to customers, the production of superior balanced products with the cemented carbide and shank (base material), and high cost performance products with waste control… all factor into the High Quality Product achieved by STARLOY.



■ About us

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Kamiyuge, Kumenancyo, Kume-gun,
Okayama 709-3612
Tel. 086-728-4511 FAX.086-728-4512
Capital: 26 million yen
Founded 10/1973
CEO: Yoshihiro Motonami
Number of employees: 42
Business Line:
1. Cemented carbide manufacture and sales
2. Wear resistant tool manufacturing and sales
3. Mold manufacturing and sales
4. Tool for mining manufacturing and sales
5. Develop and support of all products
Business: For civil engineering construction machinery and tunnel boring machine, design, production and sales of the cutter, bit and roller cutter. Production and sales of various molds
Sales Department: 2-10-22 Matsuzaki-cyo, Abeno-ku, Osaka 545-0053
TEL.06-6621-1734 FAX.06-6621-1867
East Sales Department: 4-3-5-302 Honcyo, Toda,
Saitama 335-0023
TEL.048-447-6780 FAX.048-447-6779

■ Access

- 3 hours via Chugoku Expressway from Osaka
- 1 hour and 30 minutes via 53 Route from JR Okayama Station
- 1 hour via Route 53 from Okayama IC
- 40 minutes via Route 53 from Tsuyama IC
- 30 minutes via Route 53 from Innoshou IC
- 1 hour via Route 53 from Okayama Airport
- 10 minutes by car from JR Tsuyama Line Yuge Station

STARLOY

North, Central and South America Sales and Service Representative

Procurement Specialists

a division of GOMEZ INTERNATIONAL INC.

(The Construction, Mining and Tunneling Industries Standard for Excellence)

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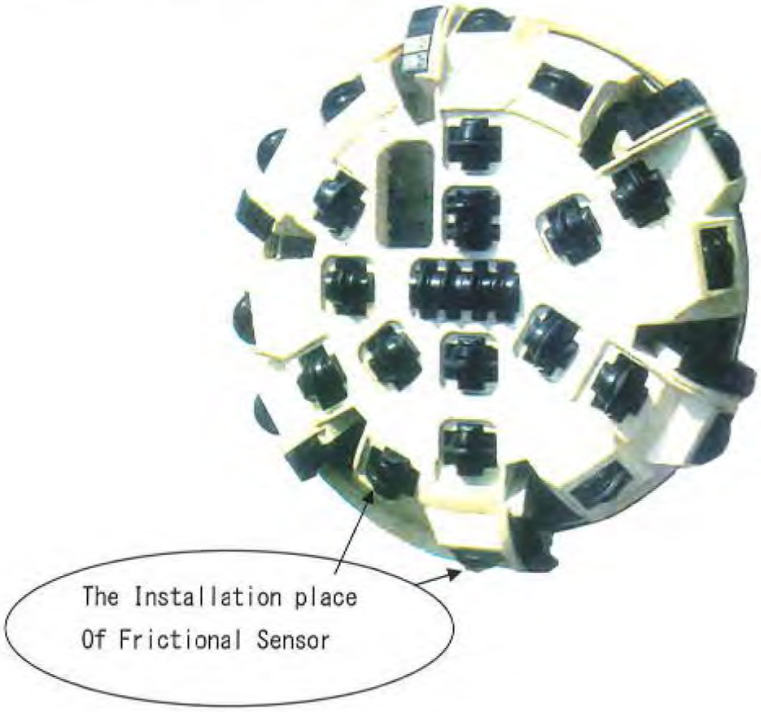
Disk Cutter Frictional Measurement Sensor

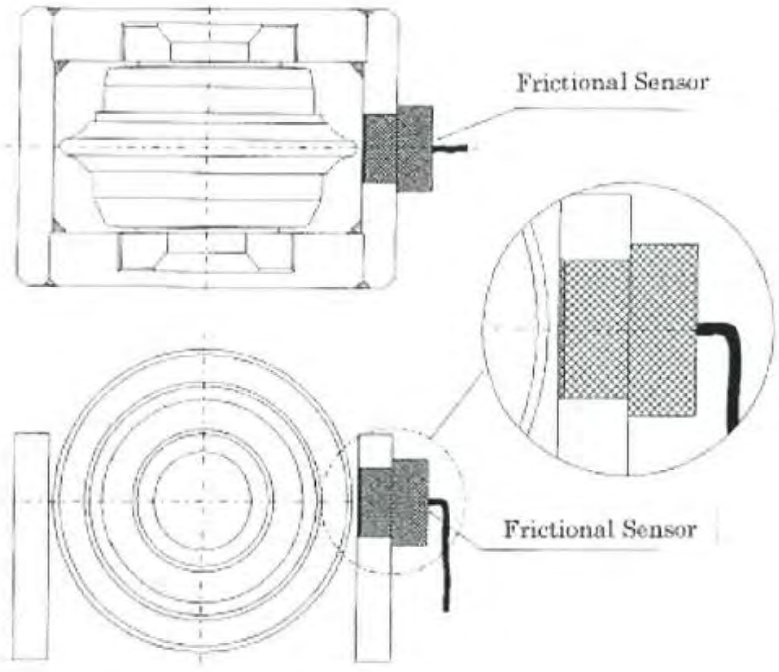
STARLOY CORP.

The Principles of Frictional Sensor

It is the sensor which uses the magnetic field.
The sensor emits the magnetic flux,
as the distance between the sensor and the edge of the blade changes
If there is any frictional wear, the magnetic flux changes.
By using this principle, the sensor changes the magnetic flux into Voltage, which enables it to measure the distance. Also, each sensor has product characteristics and could measure accordingly.

e.g.) Installation of Frictional Sensor

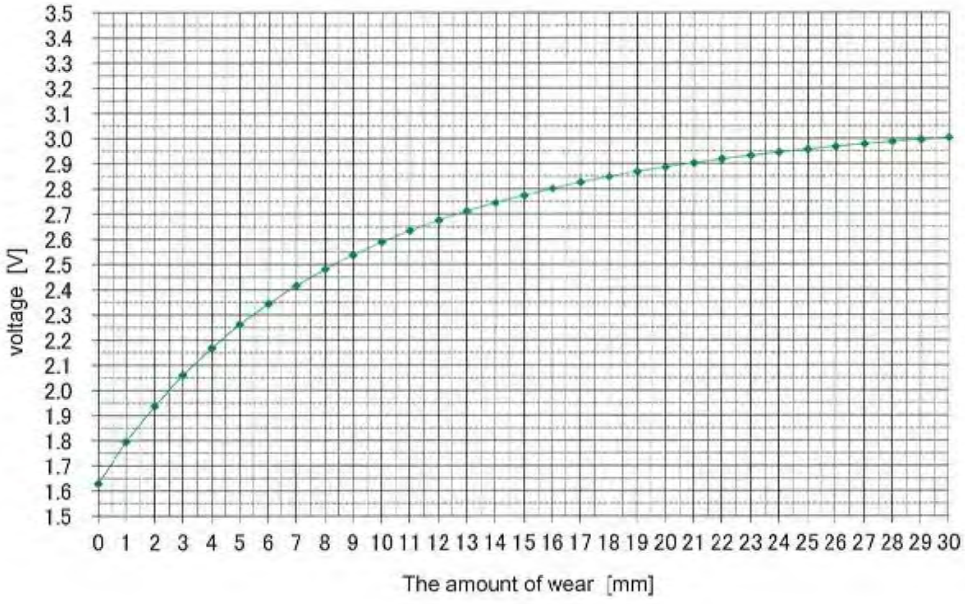




STARLOY Corp.

The Ability to Detect
Measurable bet : 0～50mm
Best use bet : 0～25mm. (Max. 30mm)
This Sensor itself also has a countermeasure against the frictional wear.

Each Sensor has its product characteristics.
Each Sensor measures according to its own characteristics when measuring.
Below is one of product characteristics examples.



STARLOY Corp.

The match bet. Housing and sensor is one of the most important parts.
So we made it sure to work out.
See below for one of examples of housing and sensor.

The outside

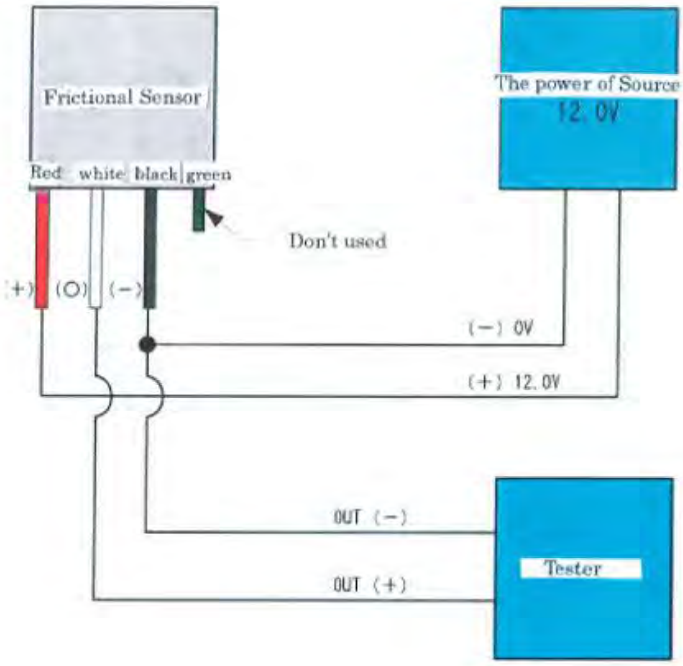
The inside

When installing the Sensor

Open hole on housing,
and install with bolts.

STARLOY Corp.

A Frictional Sensor connection Diagram



The distribution cable is covered with antifriction hydraulic hose and other for the waterproofing.
And it goes through center shaft and measures.

*Attention please
Don' t make a mistake bet. Positive (+) and negative (-).
If any mistakes, the sensor will be damaged.

STARLOY Corp.
Contact Procurement Specialists, a Division of Gomez International, Inc. for more information.
Procurement Specialists
1415 E Elwood Street, Phoenix, AZ 85040
520-836-7869

For all of your equipment and material needs.
Please Contact Us.

North, Central and South America Sales and Service Representative

FOR INFORMATION PLEASE CONTACT

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