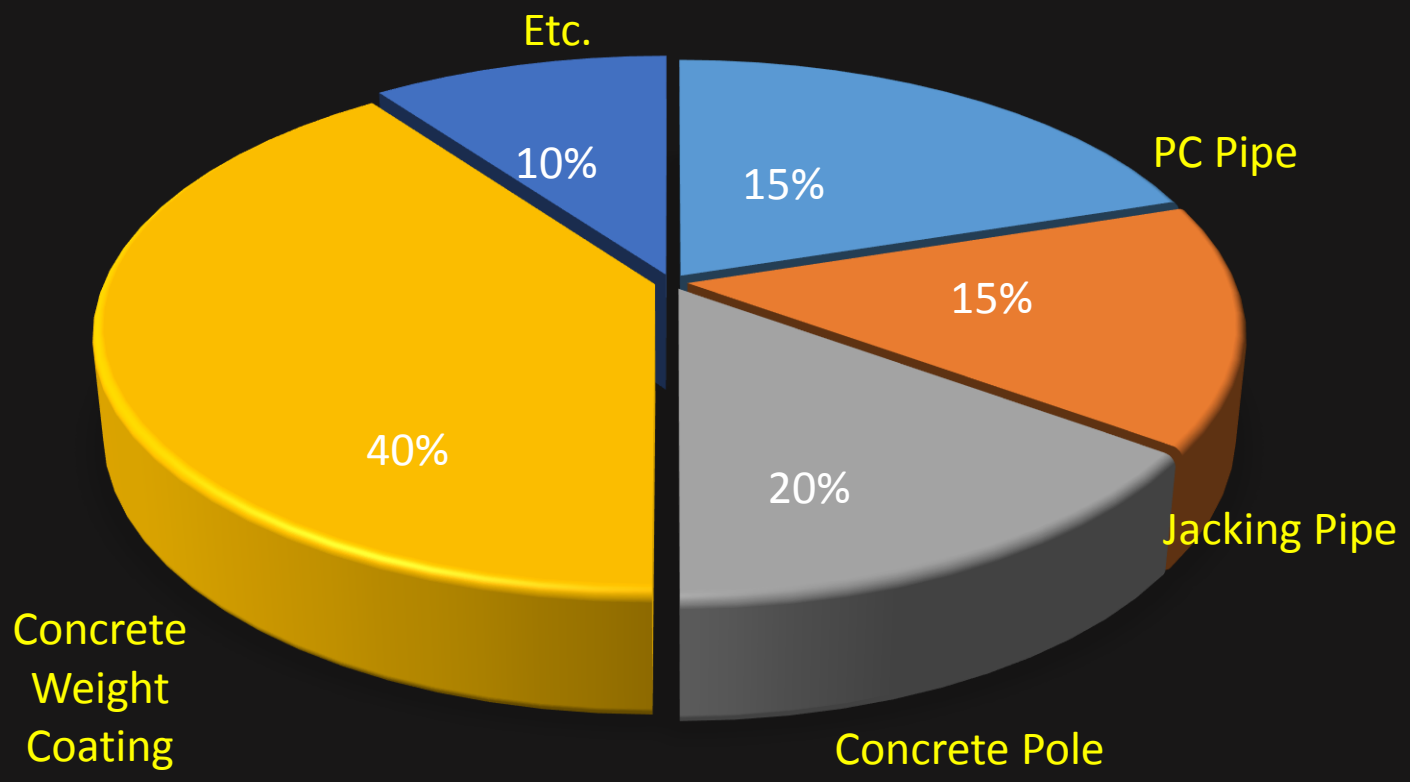
GENERAL INFORMATION

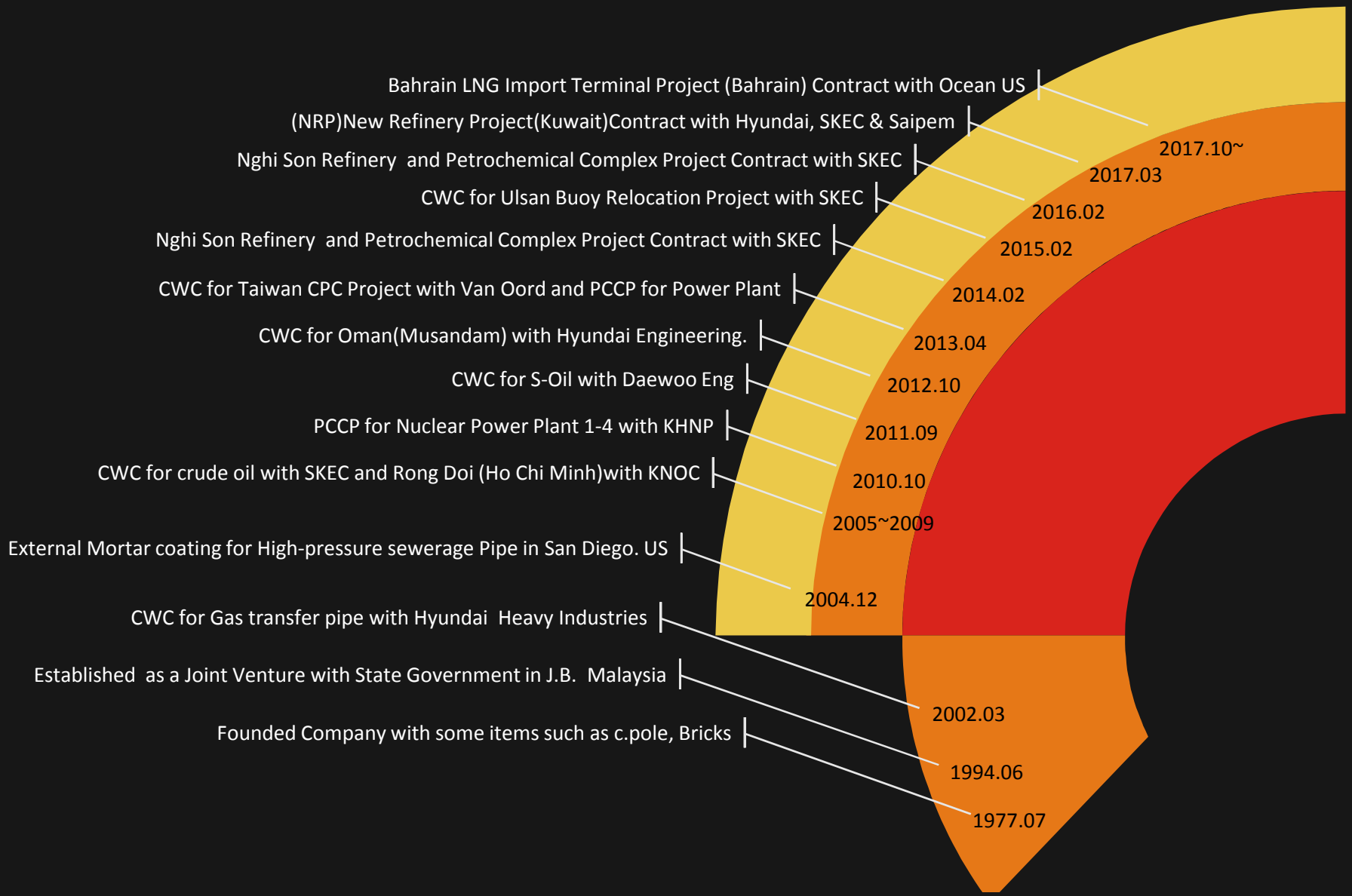
What Buyang is able to build something up?

Contents

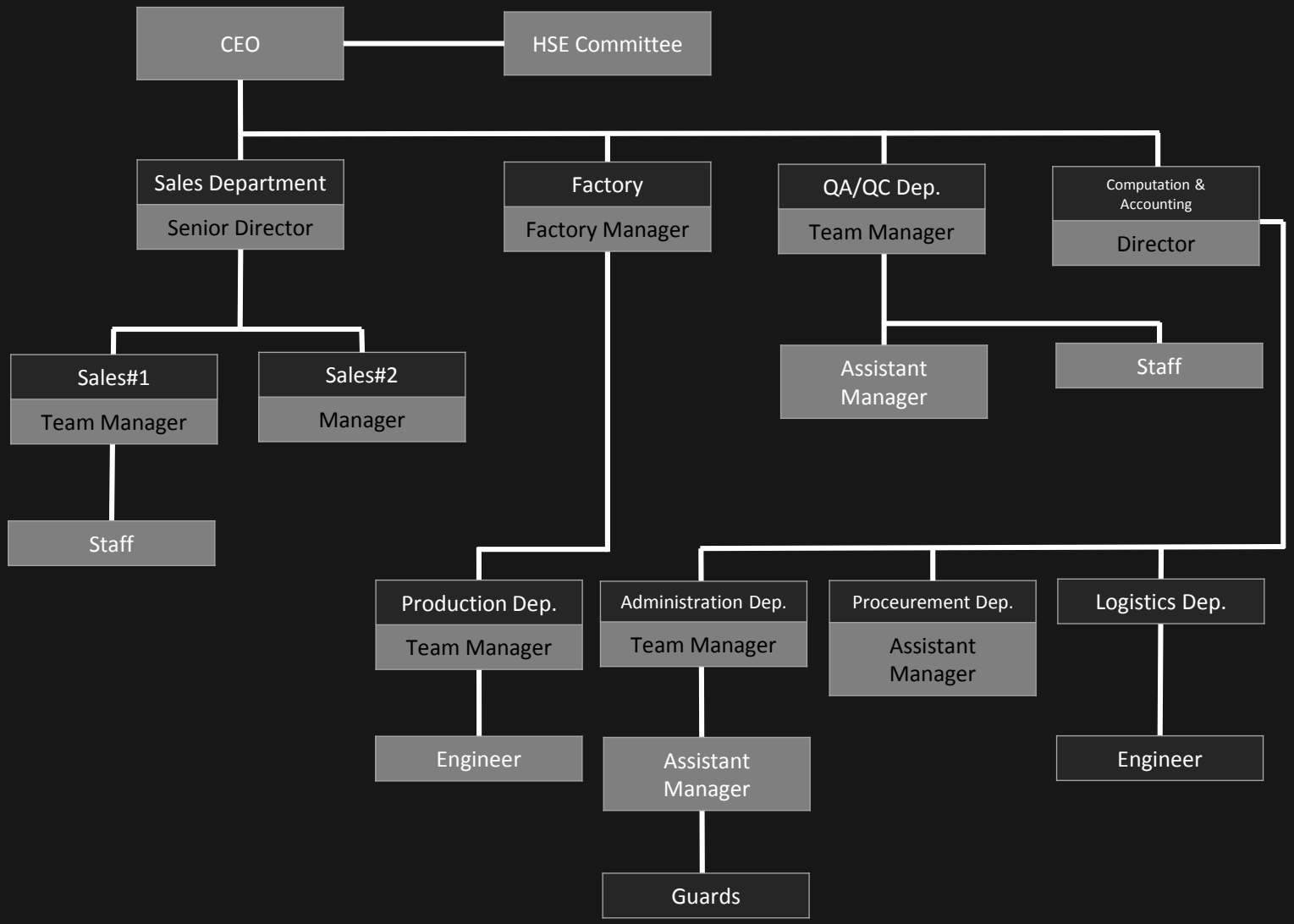
Company	Buyang Industrial Co., Ltd.
CEO	Jung Hoon Lee
Business	Pipe Coating (CWC, PE) PC/PCC/Jacking Pipe Mortar Lining & Coating
Established	1977.07
Capital	USD $2,600,000
Office	1144-4 Jukdang-ri,Bubal-eup, Icheon-city,Gyeonggi-do,Korea
Size	Land: 32.5acres / Building: 7acres

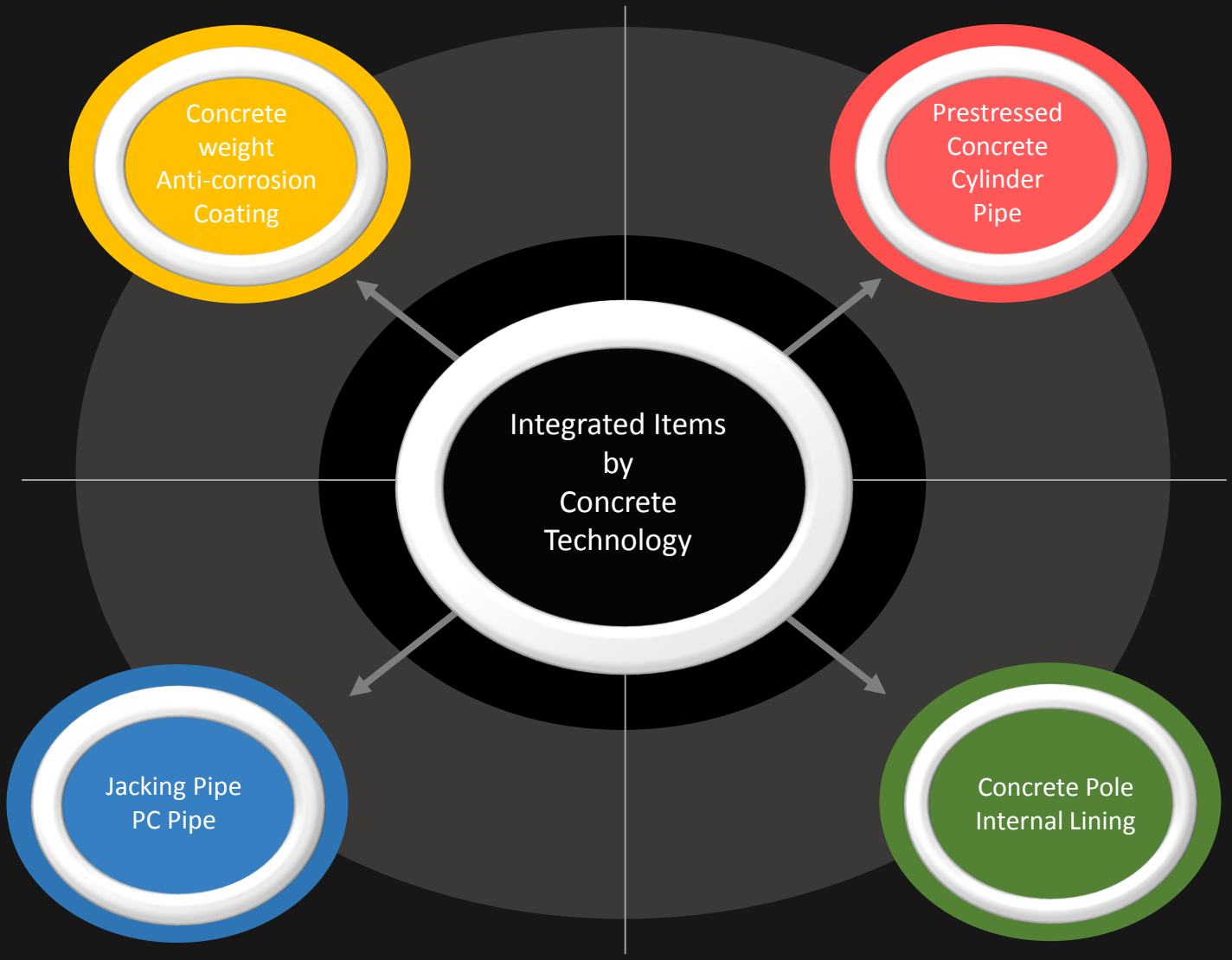

Etc.
10%
PC Pipe
15%
15%
40%
20%
Jacking Pipe
Concrete
Weight
Coating
Concrete Pole

History

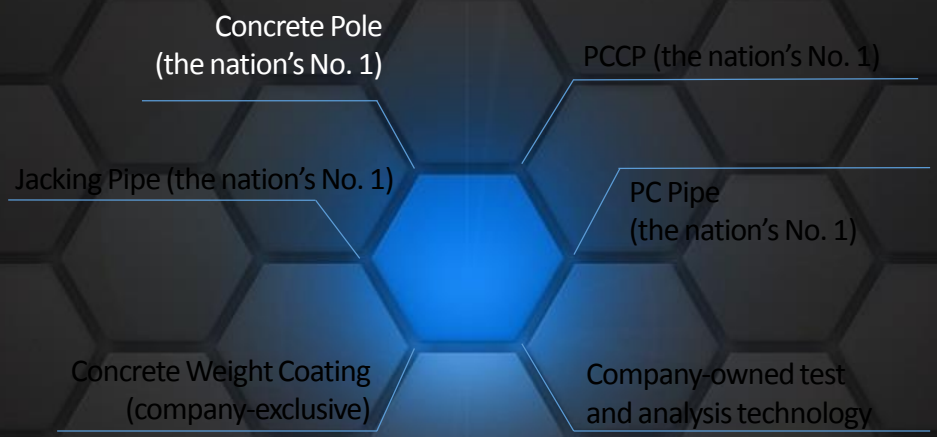

Bahrain LNG Import Terminal Project (Bahrain) Contract with Ocean US
(NRP)New Refinery Project(Kuwait)Contract with Hyundai, SKEC & Saipem
Nghi Son Refinery and Petrochemical Complex Project Contract with SKEC
CWC for Ulsan Buoy Relocation Project with SKEC
Nghi Son Refinery and Petrochemical Complex Project Contract with SKEC
CWC for Taiwan CPC Project with Van Oord and PCCP for Power Plant
CWC for Oman(Musandam) with Hyundai Engineering.
CWC for S-Oil with Daewoo Eng
PCCP for Nuclear Power Plant 1-4 with KHNP
CWC for crude oil with SKEC and Rong Doi (Ho Chi Minh)with KNOC
External Mortar coating for High-pressure sewerage Pipe in San Diego. US
CWC for Gas transfer pipe with Hyundai Heavy Industries
Established as a Joint Venture with State Government in J.B. Malaysia
Founded Company with some items such as c.pole, Bricks
2017.10~
2017.03
2016.02
2015.02
2014.02
2013.04
2012.10
2011.09
2010.10
2005~2009
2004.12
2002.03
1994.06
1977.07

Organization




Concrete weight Anti-corrosion Coating
Prestressed Concrete Cylinder Pipe
Integrated Items by Concrete Technology
Jacking Pipe PC Pipe
Concrete Pole Internal Lining

Competitiveness of Buyang Industry

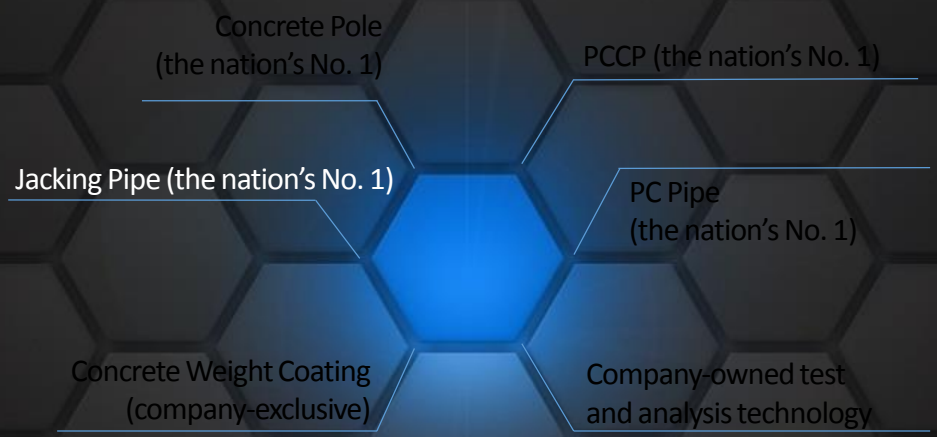


R & D (the nation's No. 1)

Developed the world's only super high-strength pole (Bending Strength=1,500 kgf)

Supplies to KEPCO for more than 20 years

Competitiveness of Buyang Industry

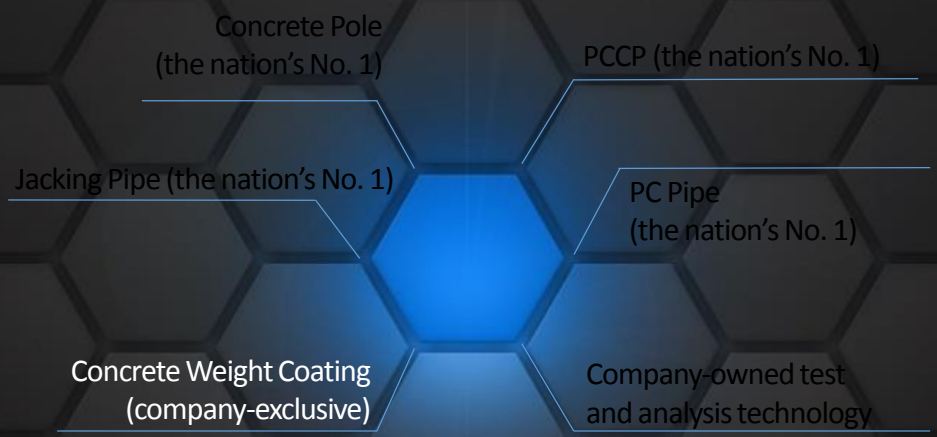


Urban underground industrial pipeline

Designs and produces 3,000-mm heavy pipes

Supplies the central and local governments for more than 10 years

Competitiveness of Buyang Industry

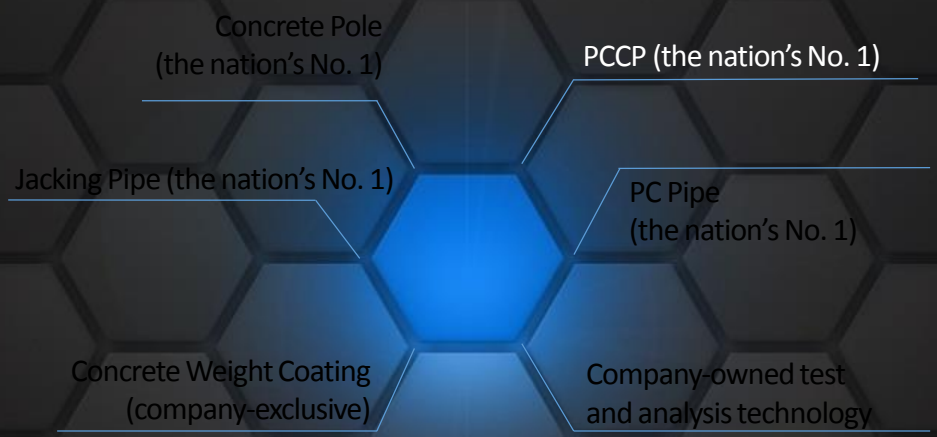


Owns technical capabilities for facility design, operation and production (world's No.1)

100% Company-developed technology

Runs the business for more than 30 years

Guarantees the world's highest quality



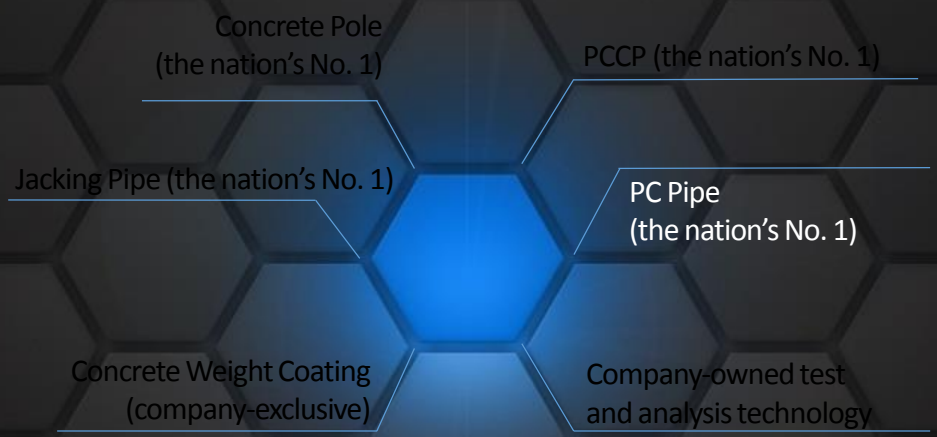
Designs/Produces (company-exclusive products)

Exclusively designs/produces pipes for nuclear power plants

Guaranteed product lifespan of more than 60 years

Supplies nuclear power plants for more than 10 years

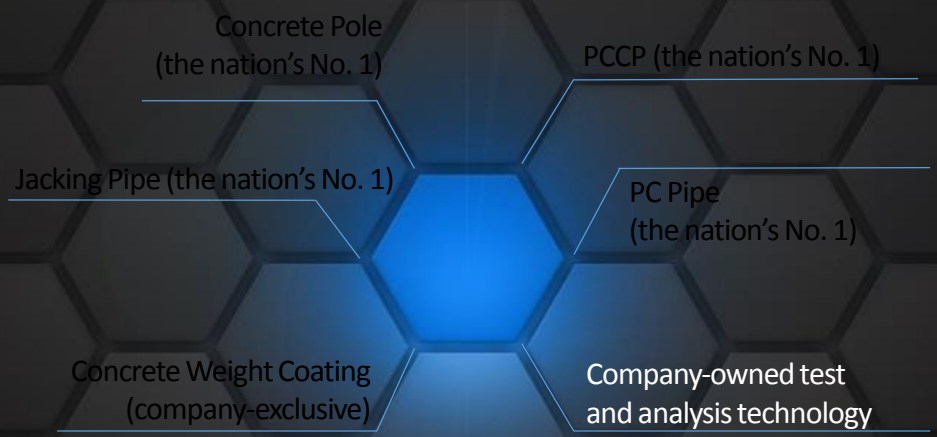
Competitiveness of Buyang Industry



The top water supply and sewage pipelines in the country

Supplies the central and local governments for more than 20 years

Company-owned technology for design, production, and testing



The best concrete product analysis

Possesses technical capabilities for mixing, testing, and analysis

Sustainable development through R & D

- **Concrete Pole**
- Prestressed Concrete Cylinder Pipe
- Concrete Weight Coating
- PC Pipe_Prestressed Concrete
- Jacking Pipe
- Inspection & Analysis

⏩ Use: power line connection, street-light, construction pile, etc.

Developed the next-generation pole (bending strength =1,500 kgf/cm3)

Supplies KEPCO for more than 20 years (registered company)

Currently supplies to Seoul and other metropolitan areas

Holds the top development capability in the country

Operates the company’s own laboratory

⏩ Use: nuclear power plants, cold and warm suction pipes and outlets

High-strength and high-pressure pipes with a guaranteed lifespan of more than 60 years.

Earthquake coefficient, topography, external and water pressure strength, geology, and site.

Seismic design, fault analysis, external pressure calculation, water pressure and water tight calculation, and material calculation.

Selection and test of materials, AWWA verification, pipeline and section design, maximum design for 60 years, joint design, and technical decision.

Inner diameter of 0.5–4 m, pipe production, pipe cutting, consideration for self-loading and gross weight, maintenance for spec strength, shipping and logistics in consideration of transportation.

Construction case of nuclear and thermoelectric power plants



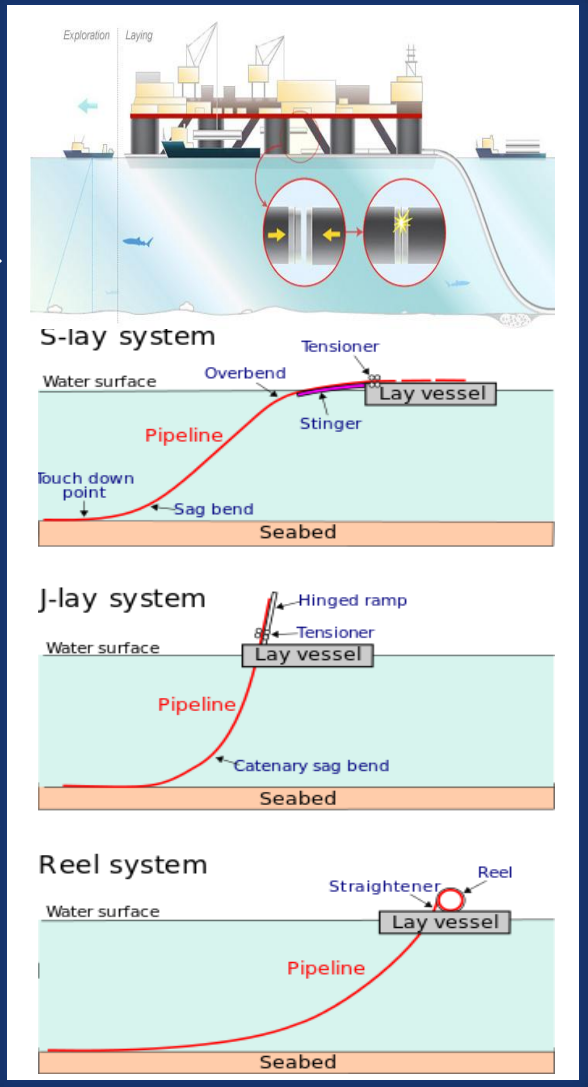

Nuclear Power Plant

Heat Power Plant



▸▸ Use: undersea oil and gas pipeline

Seabed CWC Pipe installation



▶▶ Use: sewage collection and wastewater pipelines

The best technology in the country

KS (Korean Standards)
Application of detailed dimension

Guaranteed 20-year lifespan or more

Maintain resistance against external pressure.
Easy construction

Delivers to the central and local governments

Delivers to the central and local governments.

▶▶ Use: urban underground electricity and multipurpose pipes

Used in urban underground areas

Lay pipes 2–100 m below the ground
Connect using excavation equipment
Easy use for rock fields
Quick construction
Settlement of civil complaints

Guaranteed pressure strength

Advanced excavation equipment
Maintains sufficient pressure strength
Maintains strict standards
Can be used for 20 years or more

Large-pipe production technology

3,000 mm or more
Guaranteed watertight and resistant against external pressure.
Possesses centrifugal force technology, production and construction technologies.

⏩ Use: concrete mix, strength measurement, and raw material analysis

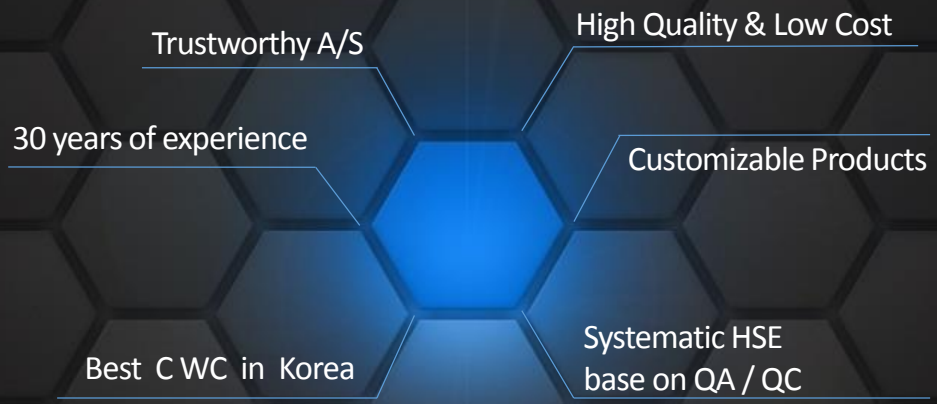
External Pressure Test

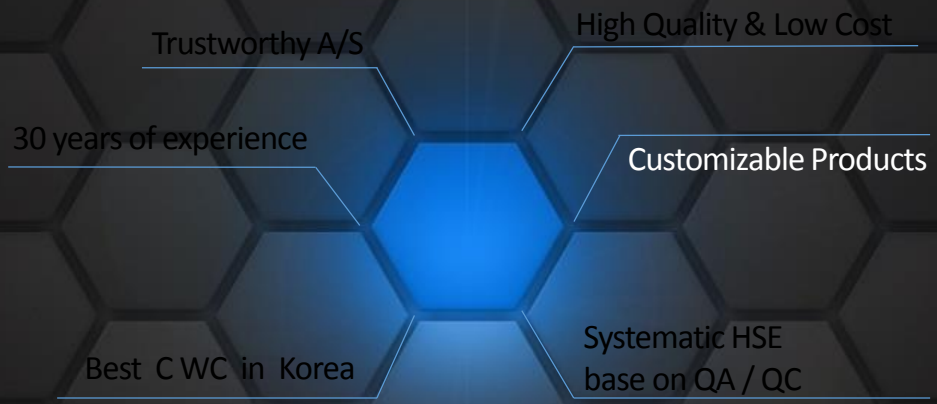
Test Report and Standard

Compressive Strength Test

Absorption Test

Product’s Strength

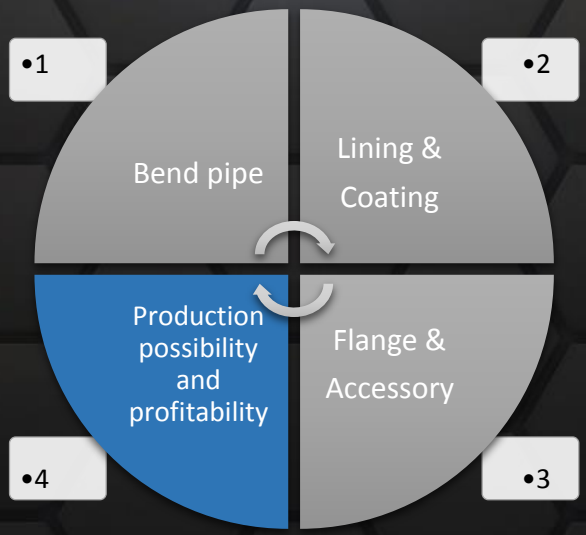




Feasibility and Profitability

Feasible and profitable products as required by customers

Profitability can be adjusted as the entire and partial system are also adjustable



Capability

Energy business (coating and cooling water pipes)

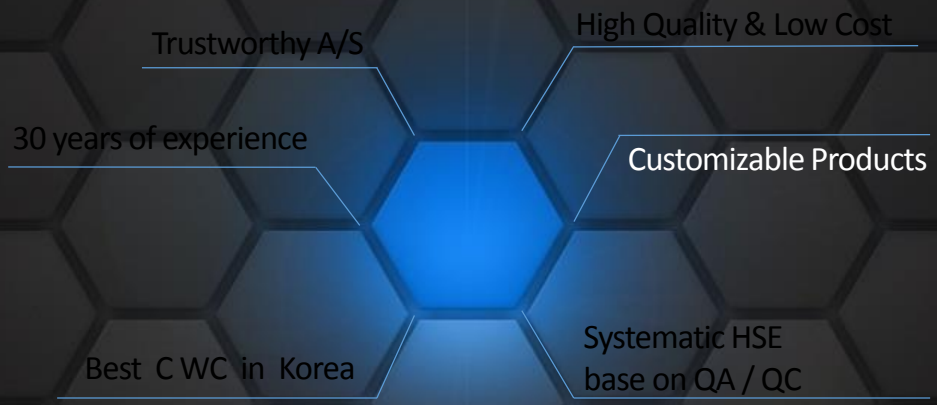
Pole (produces general poles to high-strength poles)

Fire–water pipes (lining)

Downtown electricity pipes and watercourse pipes (jacking and pc pipes)

Special pipes for nuclear power plants (PCCP)

Product's Strength



Possesses production technology for products based on customers' standards

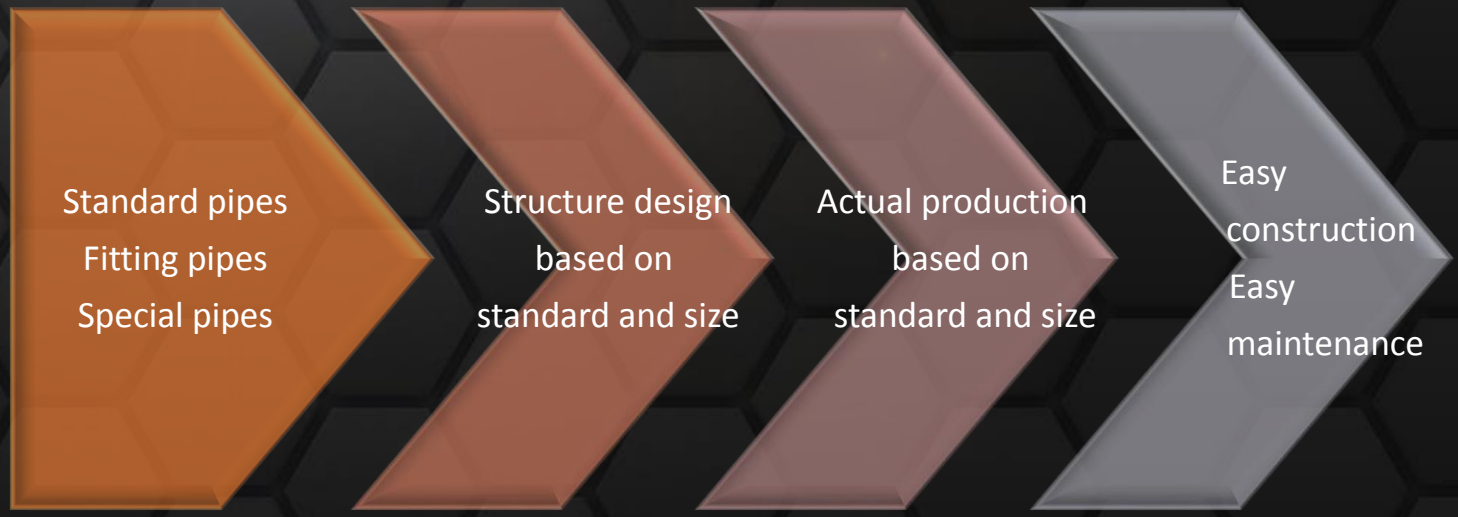
Customizable Products

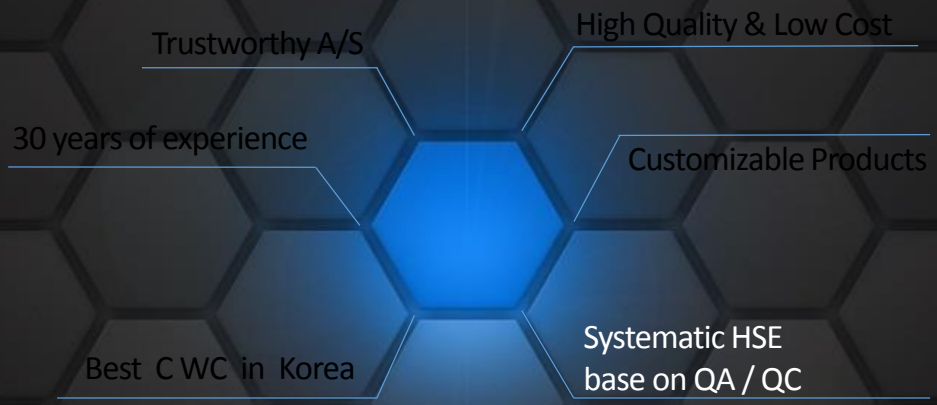
Can be produced based on experience and technology

Owns production facilities that consider the market size and maintains expandability

Possesses structure design and production design capability (dimension, product lifespan, etc.)

Presents easy management plans for product construction and maintenance



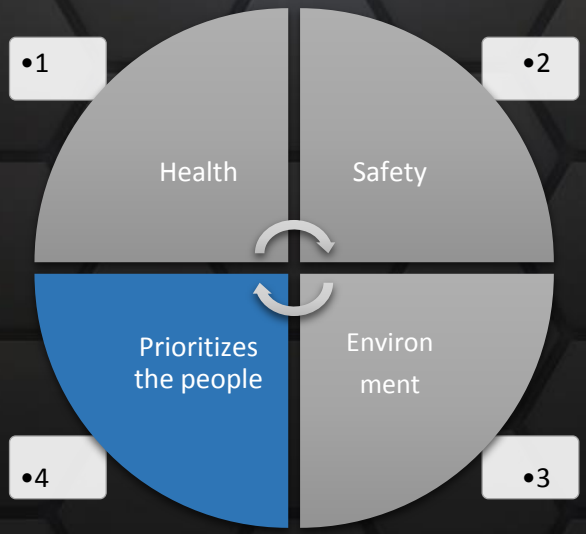


Health, Safety, and Environment

Improved and pleasant working environment for the workers' health.

Safety-first operation policy for employees and visitors.

Focuses on maintaining and supervising a working environment that is consistently compliant with regulations.



Matters for Consideration

Physical examination for all employees and working environment inspection.

Safety education, evacuation drill, company dress code, etc.

Removal of poor surroundings such as dust, noise, and waste.

Continuous supervision and development through the HSE committee.

HSE POLICY

We, Buyang Industry are committed to the Health and Safety of every person working and visiting and the preservation of the clean environment through:

- Bringing all the efforts to ensure Health and Safety of every person by enhancing HSE system with continuous and fatigueless improvements in every aspects involving humanism.
- Yesterday's HSE experience shall reflect to today's HSE system since today is also the yesterday of tomorrow.
- Innovation & Trust shall be reached with Health, Safety and clean Environment that create life-happiness of everyone.

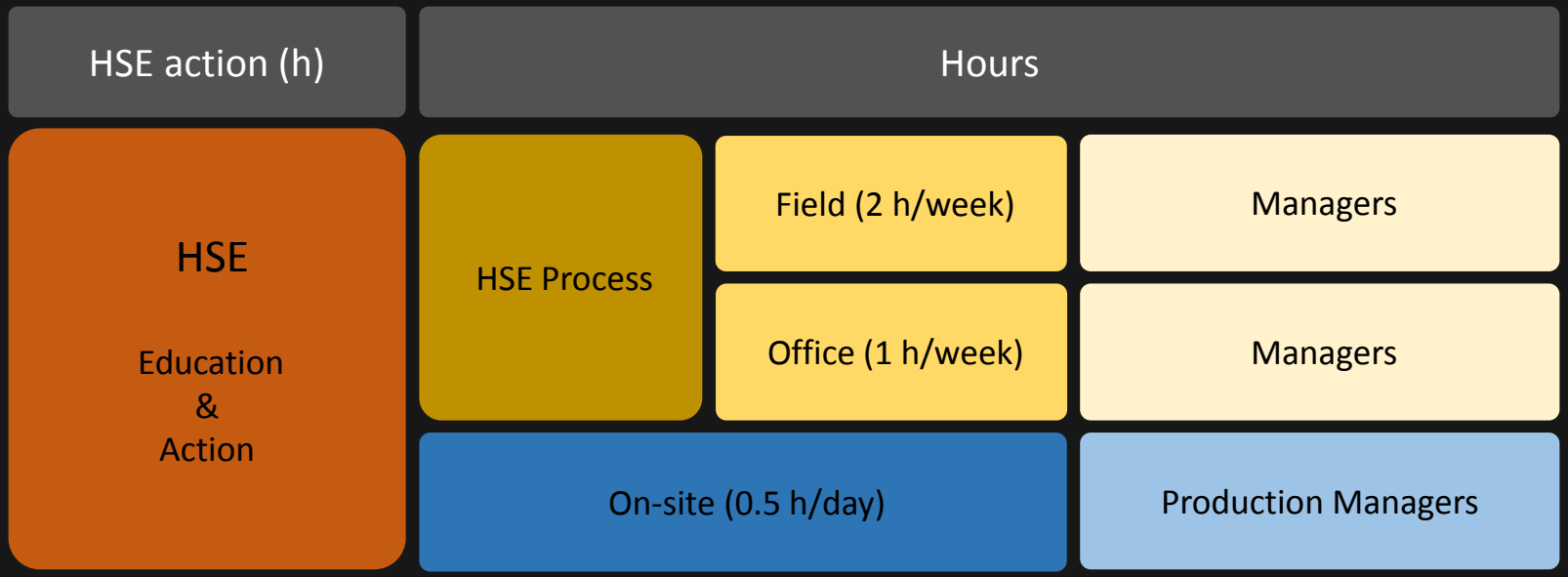
HSE Policy (to emphasize safety)

General	Protecting workers from injuries associated with pipe coating.
Application	The pipeline is coated with special materials to prevent corrosion. Coating integrity is confirmed through detection of bare spots with special detectors.
Protective Mechanism	Safe work procedures ERP (Emergency Response Plan) Manufacturer specifications Equipment maintenance procedures warning signs .
Supervisor Responsibility	Supervisors are responsible to facilitate and provide proper instruction to their workers on protection requirements and training. Work site inspection Hazard Assessment.
Worker Responsibility	1. Regularly inspect equipment. 2. Remain in operator's line of vision. 3. Follow safe work procedures when coating. 4. Use caution around moving equipment. 5. Do not jump off the equipment. 6. Do not walk on the pipe. 7. Avoid inhaling coating fumes. 8. Follow pipe coating safe work procedures step by step.

1. HSE MANAGEMENT SAFETY PHILOSOPHY
2. HSE MANAGEMENT PRINCIPLES
3. HSE MANAGEMENT SYSTEM
4. SUPERVISORY RESPONSIBILITIES
5. GROUP SAFETY MEETINGS
6. ON SITE SAFETY MEETINGS
7. REFUSAL TO WORK FOR SAFETY REASONS
8. OVERVIEW OF JOB SAFETY ANALYSIS PROCESS
9. JOB SAFETY ANALYSIS
10. RESPONSIBILITIES WITHIN JSA PROCESS
11. SAFETY ORIENTATION
12. INCIDENT INVESTIGATION & REPORTING PERFORMANCE STANDARD
13. LIFTING, HANDLING & STORAGE
14. HAZARDOUS, CHEMICAL, TOXIC SUBSTANCES, IDENTIFICATION, INSPECTION, LABELING, HANDLING, STORAGE PROCEDURES
15. ELECTRICAL
16. WASTE MANAGEMENT
17. TRANSPORTATION AND LAND
18. HOT WORK
19. FIRST AID & MEDICAL
20. SAFETY EQUIPMENT & APPLIANCES
21. WORKING AT HEIGHT
22. SCAFFOLDING
23. HAND TOOLS & PORTABLE HAND TOOLS
24. MACHINERY AND EQUIPMENT
25. RIGGING PROCEDURE
26. FOOD HANDLERS
27. FIRE &CHEMICAL SPILLAGE DRILL
28. HANDLING & STORAGE COMPRESSED GAS
29. HANDLING, STACKING PIPE
30. FIRE PREVENTION SYSTEM

Buyang Industry has a systematic H.S.E Plan made of 124pages.

We could attach the remaining H.S.E plan, if required, as an appendix.



- CEO personally giving HSE Education: Once every month 1~2hour (Every employee)

Aim to be the world's No. 1

- The KFS (Key Factor for company's Success) in the market is not the excellent product but to have an excellent quality and reasonable price.
- (ex.) "We do not compromise quality." "Continuous cost reduction by managing the system."
- Impression from productions
- Mutual growth with customers

Regulations

- Comply with ITP (International Test Procedure)
- International regulations—ASTM, ASME, AWWA, ISO, OHSAS, DNV, etc.
- Domestic regulations—KS F 4300/4400

Quality POLICY

Buyang Industry strives to offer best quality and clients' satisfactory use of production.

First, ensure

- All materials and equipment comply with contract specifications.
- All performance of the work must be in accordance with the contract.
- Workmanship must meet the contract requirements.

Thus, achieve

- Production of Excellent Quality Controlled Products.
- Accident-free Manufacture.
- Cost-and-time effective manufacturing process.

Quality Plan (QA/QC)

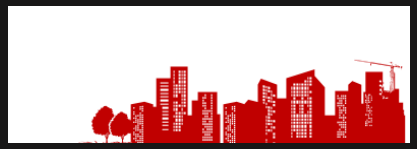
- 1. PRE QUALIFICATION PLAN → BYI-D-103
- 1.1 Introduction
- 1.2 References
- 1.3 Responsibilities
- 1.4 Coating process flow diagram
- 1.5 Coating system requirements
- 1.6 Coating process
- 1.7 Handling, transportation & Storage
- 1.8 Testing procedure
- 1.9 Inspection & Test plan
- 2. CONCRETE WEIGHT COATING PROCEDURE → BYI-D-104
- 2.1 Purpose
- 2.2 Scope
- 2.3 Reference
- 2.4 General Principles
- 2.5 Materials
- 2.6 Coating
- 2.7 Test and Inspection
- 2.8 Repair
- 2.9 Logging and Tracking
- 2.10 Handling, Storage and Transportation
- 3. ANODE INSTALLATION PROCEDUR → BYI-D-105
- 3.1 Purpose
- 3.2 Scope
- 3.3 References
- 3.4 Procedure
- 3.5 Figures
- 4. CONCRETE WEIGHT COATING PUSH OFF TEST PROCEDURE → BYI-F-302
- 4.1 Purpose
- 4.2 Scope
- 4.3 Responsibility
- 4.4 Document Control
- 4.5 Preparation
- 4.6 Test procedure
- 4.7 Safety manual
- 5. GROUND TRANSPORTATION & ON SHORE STACKING PROCEDURE → BYI-T-108
- 5.1 Summary
- 5.2 Manpower and Equipments Plan
- 5.3 Pipe Loading and Unloading
- 5.4 Pipe Onshore Stacking Plan
- 5.5 Safety

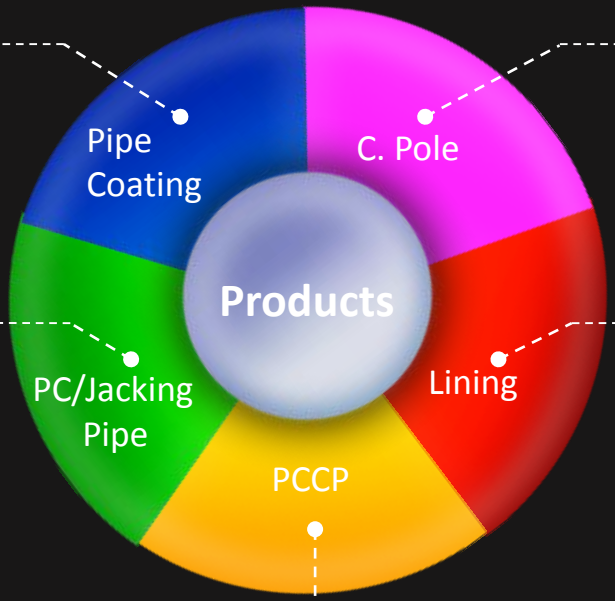
Buyang Industry has a strict Quality Plan.

We could attach the remaining, if required, as an appendix.

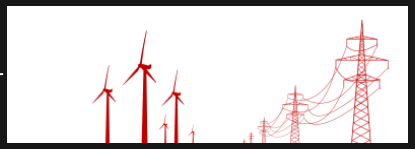
DNV : Offshore Standard
ISO : International Standard Organization
ASTM: American Standard Test Materials

KS F : Korea Standard Fabrication
ISO : 9001, Required Spec. by Customer





KS F : Korea Standard Fabrication
ISO : 9001 Quality



AWWA : 301, 304, M9
ASTM: American Standard Test Materials
ISO : International Standard Organization

AWWA : 301, 304, M9
ASTM: American Standard Test Materials
ISO : International Standard Organization

Quality Systems

ISO	KS Q ISO 9001: 2009 ISO 9001 : 2008 ISO 14001:2014 OHSAS 18001:2014
KS	KS F 4304 KS F 4405 KS F 4406

Quality Increase Action	
Education	Worker : 2 times /week (on-site) Every employee : 1 time/month
Person in charge	Person in charge at every process line

Quality Inspection Action	
Checking	Incoming Producing Outgoing
Authority	Process line stop ☞report to manager

Plant Registration

■ Form No. 8-2 Also available online: www.femis.go.kr

Plant Registration Certification Form

Reference No. 377	Date Received	Processing Time	Immediate

Company Information	Name of Company Buyang Industrial Co.,Ltd	Tel. (Tel : (031) 634-2193)
	Name of Chairperson JUNG HOON LEE	Date of Birth (Corporate Registration No.) 134411-0011758
	Address of Chairperson (Address of Company) 1144-4,Jukdang-ri,Bubal-eup,Icheon-si,Gyeonggi-do	

Plant Information	Address of Plant 260-2,Sanchon-ri,Bubal-eup,Icheon-si,Gyeonggi-do	Land Category Factory site	Property Status Owned [√] , Rented [ ]
	Plant Registration Date 1981-05-22	Start Date of Business 1998-03-05	No. of Employees Male: 47 Female: 3
	Business Line (Classification Code) Manufacture of Concrete Pipes and Structural Component Concrete Products 23326		
	Area of Site 20,067.00 ㎡	Area of Manufacturing 6,373.91 ㎡	Area of Other Facilities 1,230.91 ㎡
Registration Conditions			
Changes (Including Dates)			

I hereby apply for a Plant Registration Certificate in accordance with Article 12-3 of the *Industrial Cluster Development and Factory Establishment Act.*

2013 Year 06 Month 07 Day

Applicant JUNG HOON LEE (Signature or Stamp)

To Gyeonggi-do Icheon-si

Required Documents	Not Required	Service Charge ₩

I certify that the above plant is registered in accordance with Article 16-1/16-2/16-3 of the *Industrial Cluster Development and Factory Establishment Act.*

2013 Year 06 Month 07 Day

Gyeonggi-do Icheon-si

210 ㎜ × 297 ㎜ [Paper 70g/㎡ (Recycled)]

서류발행일: 2013년06월07일

06월07일 16:56

Business Registration

(1/1)

발급번호 Issuance number	사업자등록증명 Certificate for Business Registration (법인사업자) (Corporate Taxpayer)	처리기간 Processing period
9560-501-6869-496		즉시 Immediately

상호(법인명) Name of company	부양산업주식회사 Buyang Industrial Co., Ltd
사업자등록번호 Business registration number	126-85-24558
성명(대표자) Name of representative	이정훈 JUNG HOON LEE
주민(법인)등록번호 Resident(Corporation) registration number	134411-0011758
사업장소재지 Address	경기 이천 부발 산촌 120-1 ,260-2,-3 Gyeonggi-do Icheon-si Bubal-eup 120-1, 120-1, Sanchon-ri, Bubal-eup, Icheon-si, Gyeonggi-do, Korea
개업일 Date of business commencement	2002년(Year) 12월(Month) 28일(Day)
사업자등록일 Date of business registration	2002년(Year) 12월(Month) 28일(Day)
업태 Business type	제조 Manufacturing
종목 Business item	Manufacture of Cellulose Fiber Cement Products

공동사업자 Joint business owner	성명(법인명) Name (Name of company)	주민(사업자)등록번호 Resident(Business) registration No.
	해당사항없습니다. (NO DATA)	

위와 같이 증명합니다.
We hereby certify the above.

발급부서 Department	민원봉사실 Taxpayer Service Center
담당자 Staff in charge	[illegible]
연락처 Telephone No.	(031)644-0226

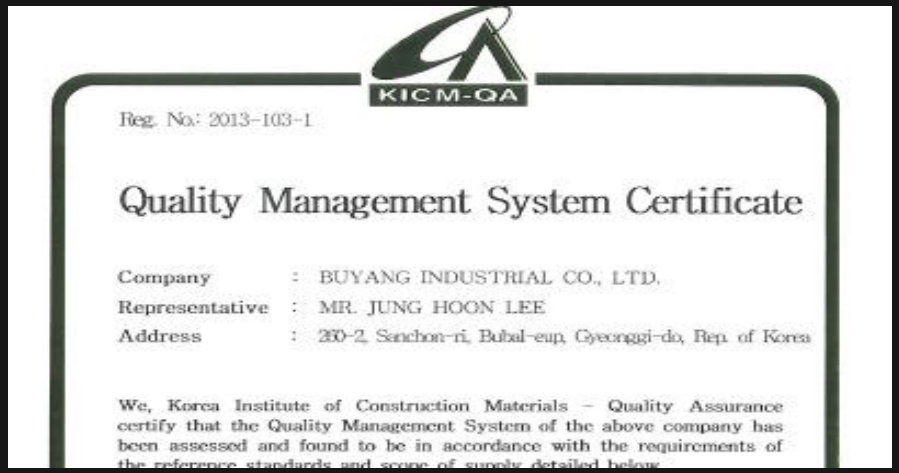
2014년 1월 10일
Year Month Day

이천세무서장 (인)
Head of Icheon District Tax Office

국세청

◆ 본 증명은 국세청 홈택스(www.hometax.go.kr)에서 [illegible]

ISO 9001 (Quality)



KICM-QA

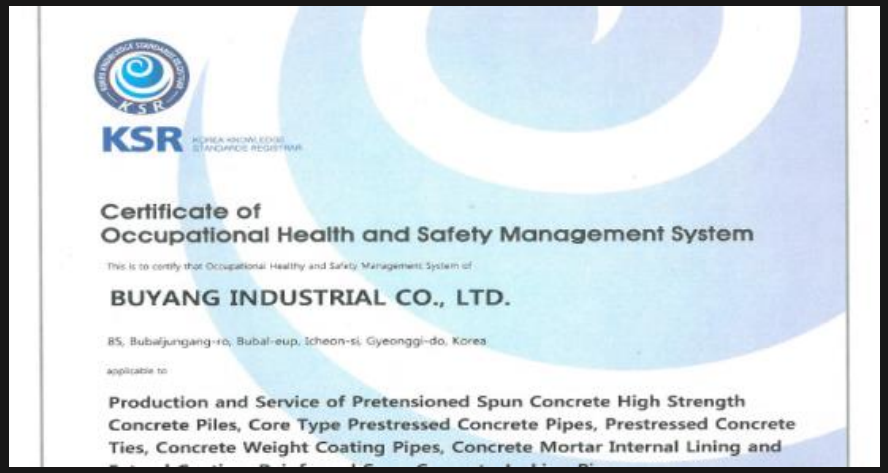
Reg. No.: 2013-103-1

Quality Management System Certificate

Company : BUYANG INDUSTRIAL CO., LTD.
Representative : MR. JUNG HOON LEE
Address : 260-2, Sanchon-ri, Bubal-eup, Gyeonggi-do, Rep. of Korea

We, Korea Institute of Construction Materials – Quality Assurance certify that the Quality Management System of the above company has been assessed and found to be in accordance with the requirements of

OHSAS 18001 (Health & Safety)



KSR

Certificate of
Occupational Health and Safety Management System

This is to certify that Occupational Healthy and Safety Management System of

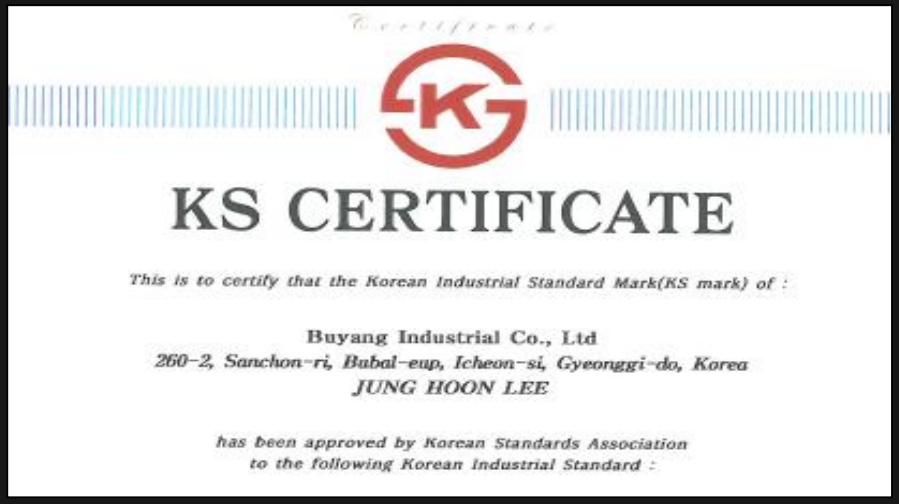
BUYANG INDUSTRIAL CO., LTD.

85, Bubaljungang-ro, Bubal-eup, Icheon-si, Gyeonggi-do, Korea

applicable to

Production and Service of Pretensioned Spun Concrete High Strength Concrete Piles, Core Type Prestressed Concrete Pipes, Prestressed Concrete Ties, Concrete Weight Coating Pipes, Concrete Mortar Internal Lining and

KS F 4304



KS CERTIFICATE

This is to certify that the Korean Industrial Standard Mark(KS mark) of :

Buyang Industrial Co., Ltd
260-2, Sanchon-ri, Bubal-eup, Icheon-si, Gyeonggi-do, Korea
JUNG HOON LEE

has been approved by Korean Standards Association to the following Korean Industrial Standard :

ISO 14001 (Environment)

Production and Servicing of Pretensioned Spun Concrete High Strength Concrete Piles, Core Type Prestressed Concrete Pipes, Prestressed Concrete Ties, Concrete Weight Coating Pipes, Concrete Morter Internal Lining and External Coating, Reinforced Spun Concrete Jacking Pipe

Certificate Issue Date :01st August 2014
Expiration Date : 31st July 2017
IAF Sector. : 16

Initial issued date : 01th August 2014
Certificate No. : EA046414

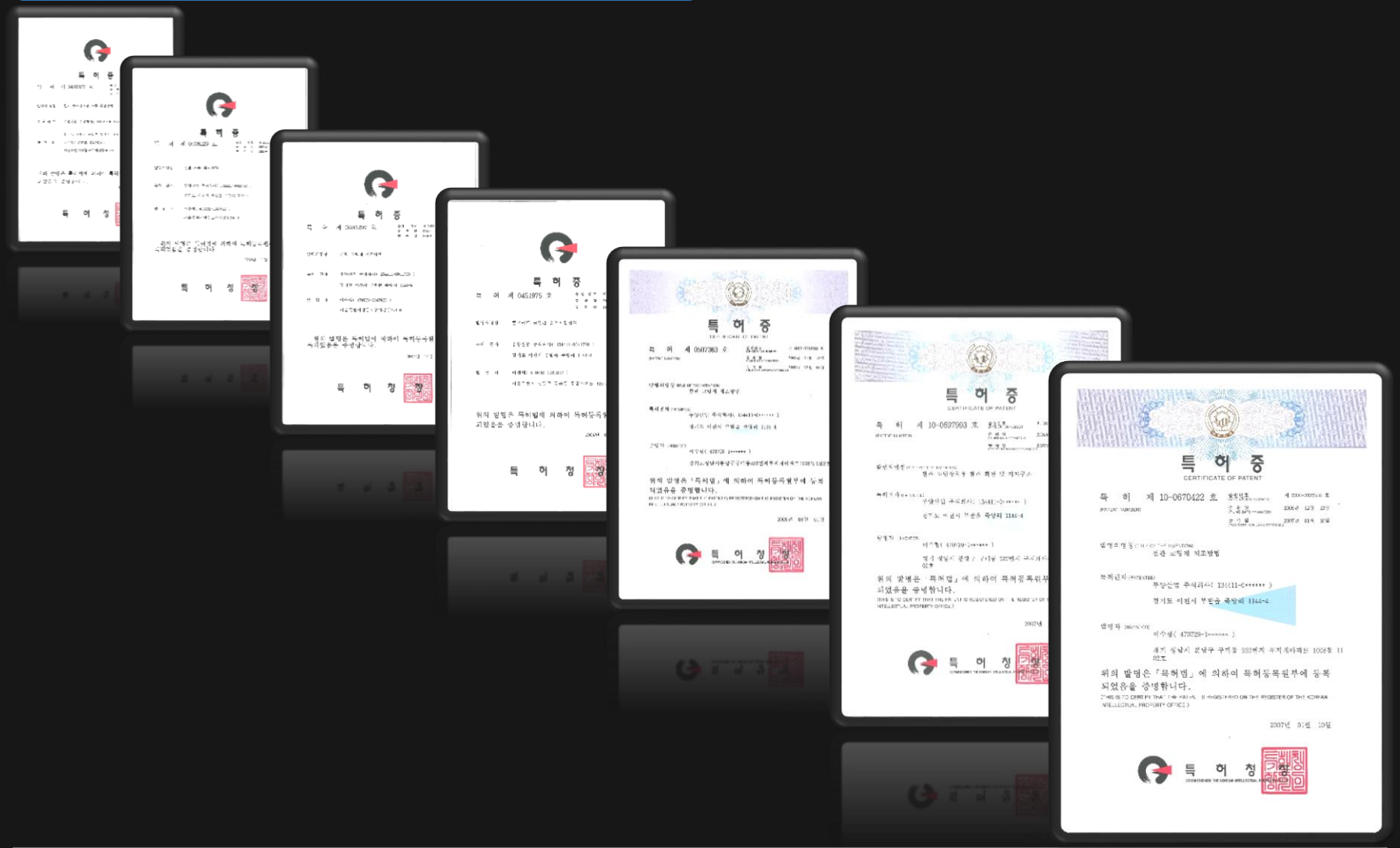
The Seal of ICR Limited was here to affixed in the presence of :

President

IAF ACCREDIA

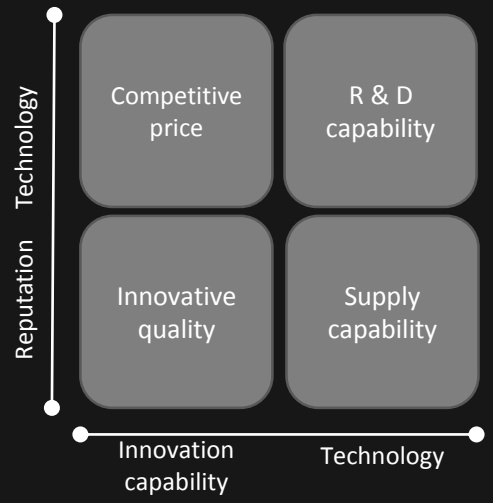
International Certification ICR ISO 14001 REGISTERED FIRM Registrar Ltd.

Patents



30-year qualified company

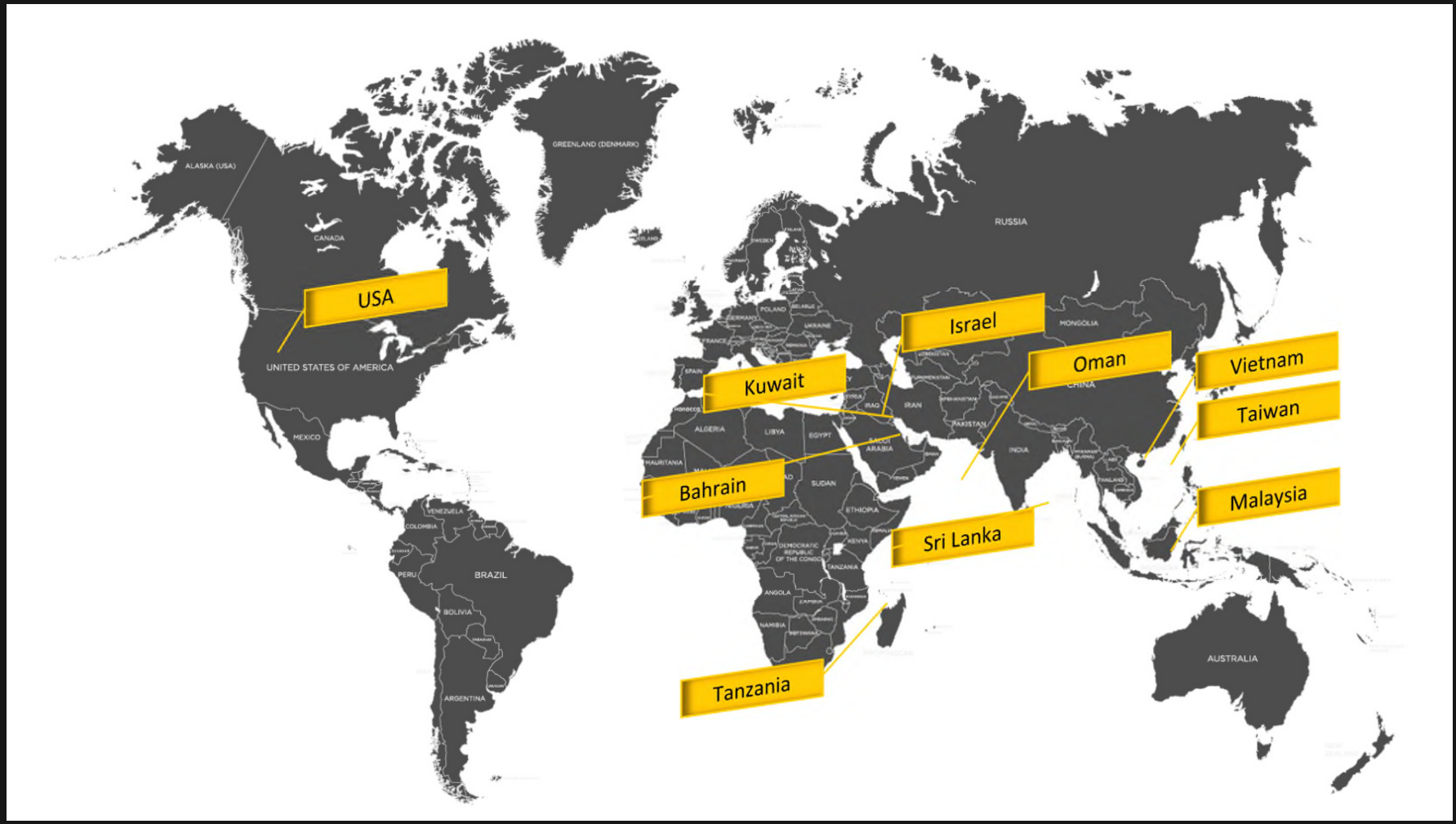
- With our years of project experience, we are able to produce products according to any condition and specification.
- We possess the power to lead in the related fields.



Differentiation / Advantages

- Possesses industry-leading technology and expertise
- Experience with projects that make Buyang Industry advance as a global company

Overseas Projects



San Diego. CA. USA	Mortar Lining

Applied Spec	AWWA C205 / ASTM	AWWA: American Water Works Association(C205) ASTM: American Standard Testing Materials

Compressive Strength: min 31 MPa
Inside Diameter: 4 inch ~ 98 inch

Length: min 2m ~ 12m
Lining coating: over 4mm

Central and Local government	PC Pipe
Applied Spec	ASTM / ASME / KS F

ASTM: American Standard Testing Material
AWWA: American Water Works Association(C302)
KS F: Korea Standard (F4405)

Compressive Strength: min 500 kg/cm^2
Inside Diameter: 500mm ~ 3,000mm

Length: min 4m, 4.5m
Lining coating: over 6mm

Central and Local government

PC Pipe

PC Pipe Experience

Delivery place	External diameter	Weight	Total distance	Year
Central government	500 ~ 3,000mm	1.5 ~ 8ton	20,000m	2010 ~ 2014 (for 5years)
Big company	500 ~ 2,400mm	1.5 ~ 6.5ton	10,000m	
Local government	500 ~ 2,400mm	1.5 ~ 5.5ton	40,000m	2000~2009 (for 10years)
Small & Medium company	500 ~ 3,000mm	1.5 ~ 5.5ton	20,000m	

Joint Venture with Johor Baru State, Malaysia	Concrete Pole

Applied Spec	ASTM / ASME / KS F	ASTM: American Standard Testing Material ASME: American Standard Material Engineering KS F: Korea Standard(F4304)

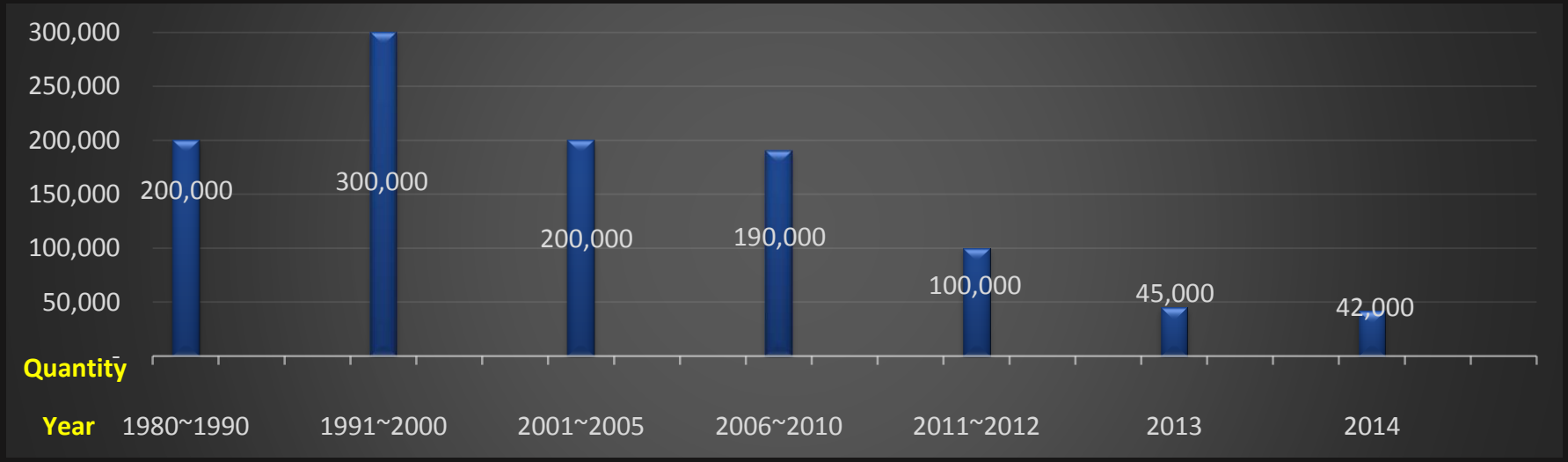
Compressive Strength: 500 ~ 1,200 kgf/cm^2
Pole Length: 10m ~ 16m

Crack Strength: 350, 500, 700, 1,000kgf
Weight: 860 ~ 2,200 kg

Joint Venture with Johor Baru State, Malaysia

Concrete Pole

Concrete pole Experience



Major client

KEPCO

Korea Electric Power Corporation

Type of delivery

- General pole
- Light load pole
- Heavy load pole
- High strength pole

Production year	Production quantity
1980 ~ 1990	200,000pcs
1991 ~ 2000	300,000pcs
2001 ~ 2005	200,000pcs
2006 ~ 2010	190,000pcs
2011 ~ 2012	100,000pcs
2013 ~ 2014	87,000pcs

Central and Local government	Jacking Pipe
Applied Spec	ASTM / ASME / KS F

ASTM: American Standard Testing Material
ASME: American Standard Material Engineering
KS F: Korea Standard F

Compressive Strength: 700~1,000 kgf/cm^2
Inside diameter: 800mm ~ 3,000mm

Length: 1.2 ~ 2.5m
Weight: 1.4ton ~ 14ton

Central and Local government

Jacking Pipe

Jacking Pipe Experience

Delivery place	External diameter	Weight	Total distance	Year
Central government	500 ~ 3,000mm	1.5 ~ 8ton	25,000m	2010 ~ 2014 (for 5years)
Big company	500 ~ 2,400mm	1.5 ~ 6.5ton	20,000m	
Local government	500 ~ 2,000mm	1.5 ~ 5.5ton	40,000m	2000~2009 (for 10years)
Small & Medium company	500 ~ 2,000mm	1.5 ~ 5.5ton	30,000m	

Korea Hydro & Nuclear Power Co.	Prestressed Concrete Cylinder Pipe

Applied Spec	AWWA 301, 304, M9 /KS F	AWWA: American Water Works Association, C301 / 304, M9 KS F: Korea Standard(F4406)

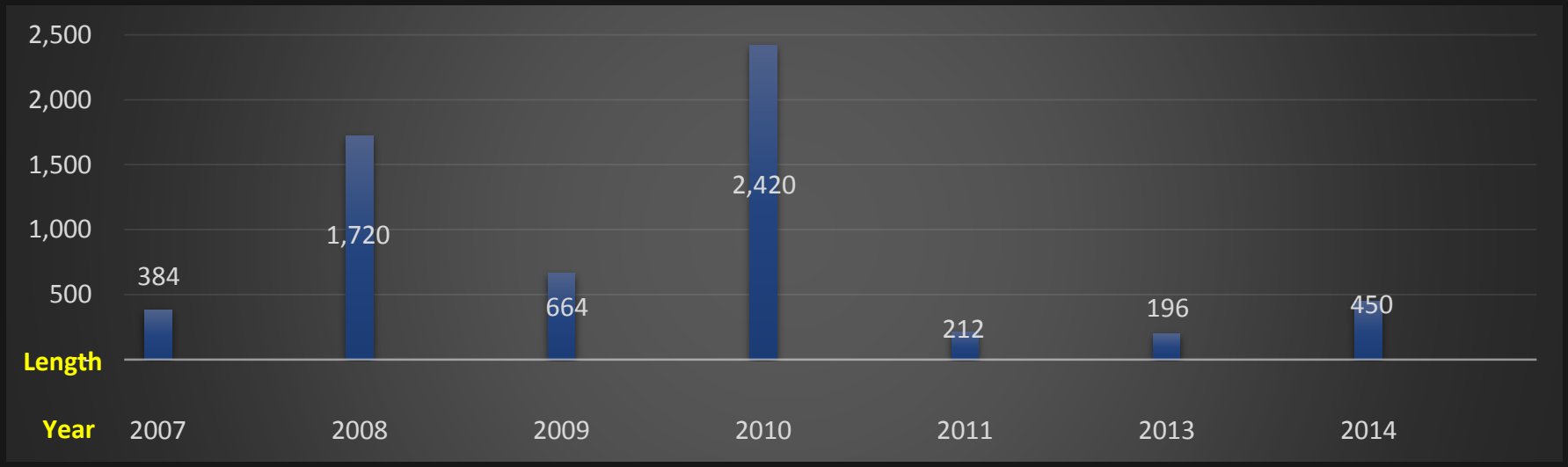
Strength: min 200 kg/cm^2
Outside Diameter: 4 inch ~ 98 inch

Density: min 1,950 kg/m^3
Lining coating: over 6mm

Korea Hydro & Nuclear Power Co.

PCCP

PCCP Experience



Major client

Korea
Hydro & Nuclear
Power Co.,Ltd

Type of delivery

Ø700/750mm
Ø800mm
1000/1100mm
Ø1200mm

Year	Quantity (M)
2007	150m(Bend)
2008	1,720m(Straight)
2009	420m(B/S)
2010	2,420m(Straight)
2011	212(Bend)
2013	196(Bend)

Vietnam, Oman, Tanzania, Taiwan, Brunei, Sri Lanka, Israel

Concrete Weight Coating

Applied Spec	DNV Submarine

ASTM: American Standard Testing Material
ISO: International Standard Organization (21809-5)
DNV: Det Norske Veritas (DNV-5s-F101)

Pipe Length: max 12.5m
Outside Diameter: 4 ~ 50 inch

Compressive strength: 40 ~ 50MPa
Coating Thickness: 20T ~ 150T

PROJECT

BUYANG INDUSTRY

Vietnam, Oman, Tanzania, Taiwan, Brunei, Sri Lanka, Israel

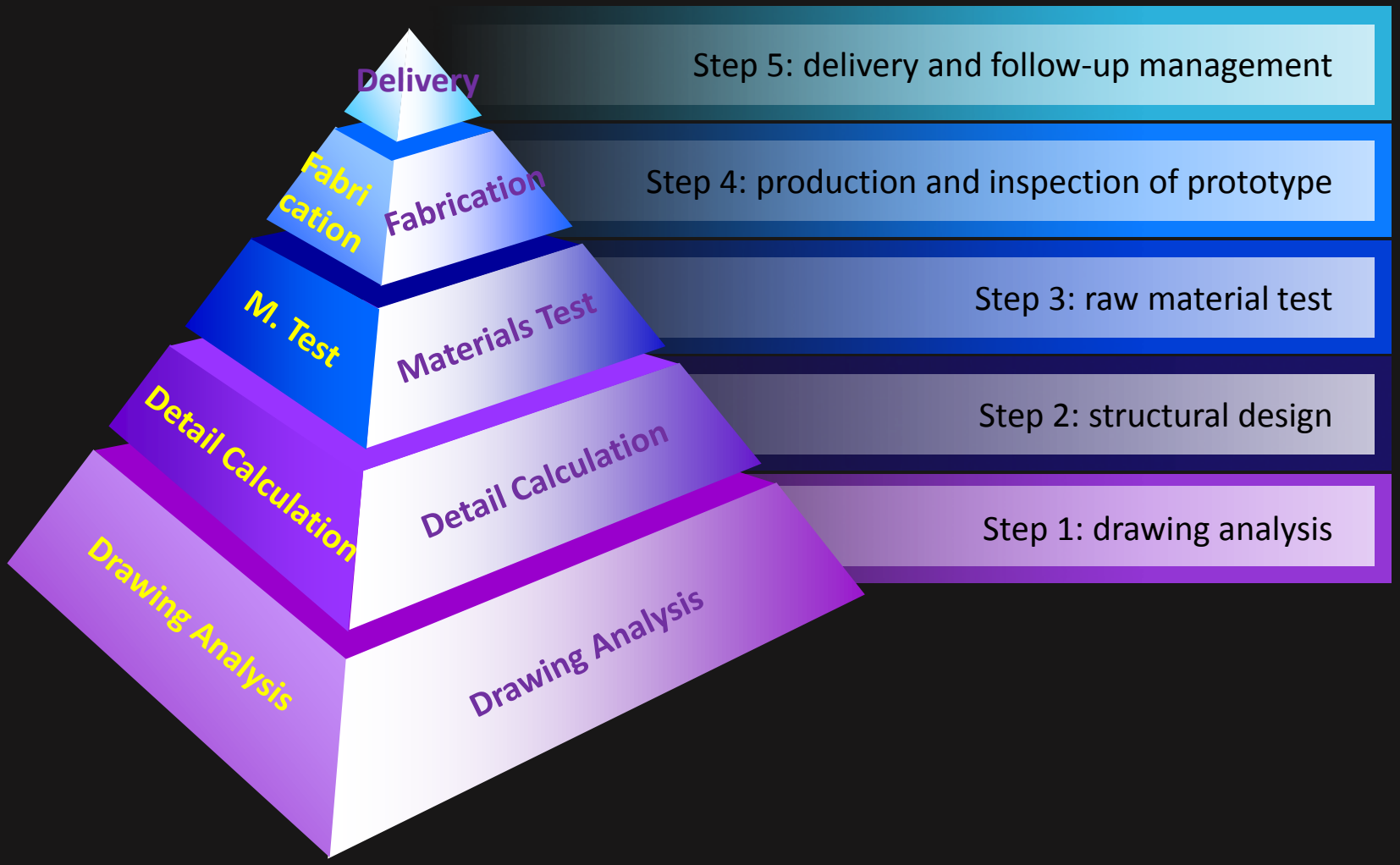
CWC / Lining Experience

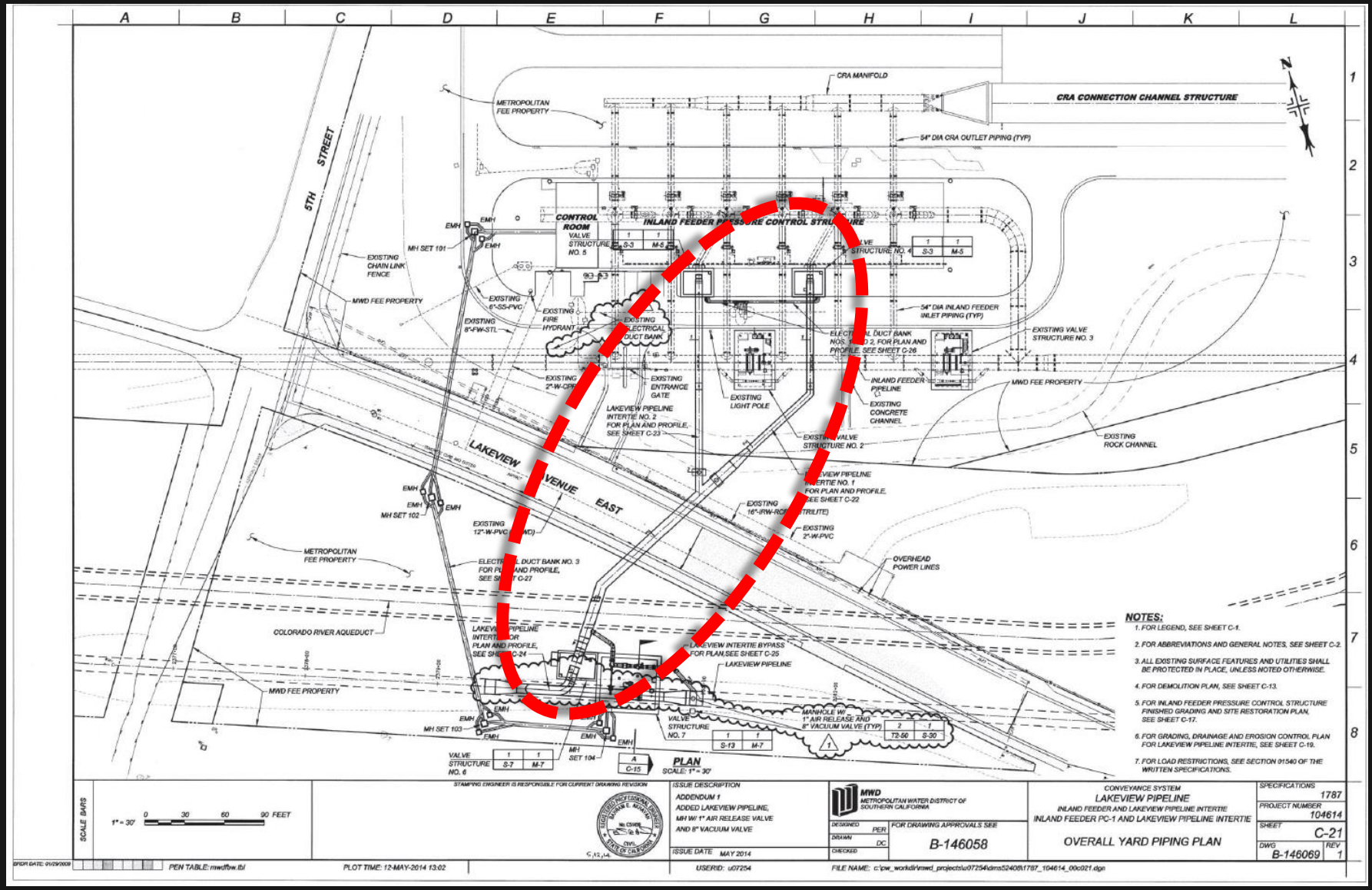
YEAR	PROJECT NAME	PIPE OD	CWC THK	LENGTH
2017	Bahrain LNG Import Terminal Project(on going)	24”	50T,70T	4,953m
2016	Al Zour New Refinery Project(NRP)	30”	80T,40T	90,500m
2015	Ulsan Buoy Transfer Project	44”,14”	105T,50T	9,800m
2014	Vietnam, Nghi Son Petrochemical Complex PJT	48”	110T, 115T, 120T, 130T	70,340m
2013	Taiwan, Shalung No.1 Offshore Crude Oil Pipeline	42”	90T, 130T	4,792 m
	Brunei Shell Petroleum Project	6”, 10”, 20”, 32”	50T, 60T, 100T	96 m
2012	Oman Musandam Gas Plant Project	30”, 40”	75T, 85T, 90T, 120T	5,160 m
	S-OIL NEW SPM	42”	105T	3,240 m
2011	Nakdong River 25	22”	50T	564 m
2009	Sri Lanka Colombo Port Expansion Project	36”	105T, 114T	10,056 m
2007	Israel PEI Haifabay Pipeline Project	42”	82T	10,500 m
	SK Crude Oil Unloading System Relocation Project			
2005	Daegu to Tongyoung Sec. 2 Gas Line	30”	60T	646 m
	Vietnam Rong Doi - Tay Natural gas pipe line	18”	25T, 40T, 80T	58,567 m
2004	SK #2 Buoy Relocation Project	36”	77T	1,392 m
	Local gas pipe line River crossing gas pipe line	16”	50T	866 m
	U.S.A. CA, Sandiego Rancho Penasquitos	97”, 103”	25.4T – Internal Coating	855 m
2003	Tanzania Songo Limited Project	14”	40T	284 m
	Ulsan harbor river Crossing gas pipe line			
2002	Local gas pipe line Nakdong river oil line	16”, 22.5”	60T	688 m
	EAST Sea Sec. 1 Natural gas pipe line	14”	40T	61,356 m
2001	Local gas pipe line Han river crossing line	30”	60T	720 m
2000	Local gas pipe line Han river crossing line	30”	60T	1,272 m
	Nakdong river Crossing oil pipe line	22”	60T	343 m
	Local gas pipe line Incheon submarine pipeline	36”	80T	17,256 m

Sri Lanka / Oman

Southeast Asia


U.S.A


Delivery
Fabri cation
Fabrication
M. Test
Materials Test
Detail Calculation
Detail Calculation
Drawing Analysis
Drawing Analysis
Step 5: delivery and follow-up management
Step 4: production and inspection of prototype
Step 3: raw material test
Step 2: structural design
Step 1: drawing analysis


CRA MANIFOLD
CRA CONNECTION CHANNEL STRUCTURE
METROPOLITAN FEE PROPERTY
54" DIA CRA OUTLET PIPING (TYP)
5TH STREET
CONTROL ROOM
INLAND FEEDER PRESSURE CONTROL STRUCTURE
VALVE STRUCTURE NO. 5
VALVE STRUCTURE NO. 4
EXISTING CHAIN LINK FENCE
MH SET 101
MWD FEE PROPERTY
EXISTING 6"-SS-PVC
EXISTING 8"-FW-STL
EXISTING FIRE HYDRANT
EXISTING ELECTRICAL DUCT BANK
54" DIA INLAND FEEDER INLET PIPING (TYP)
EXISTING VALVE STRUCTURE NO. 3
EXISTING 2"-W-CPVC
EXISTING ENTRANCE GATE
EXISTING LIGHT POLE
INLAND FEEDER PIPELINE
EXISTING CONCRETE CHANNEL
EXISTING ROCK CHANNEL
LAKEVIEW PIPELINE INTERTIE NO. 2 FOR PLAN AND PROFILE, SEE SHEET C-23
EXISTING VALVE STRUCTURE NO. 2
LAKEVIEW AVENUE EAST
LAKEVIEW PIPELINE INTERTIE NO. 1 FOR PLAN AND PROFILE, SEE SHEET C-22
EXISTING 16"-RW-RCP (TRIPLITE)
EXISTING 2"-W-PVC
MH SET 102
EXISTING 12"-W-PVC (MWD)
METROPOLITAN FEE PROPERTY
OVERHEAD POWER LINES
COLORADO RIVER AQUEDUCT
LAKEVIEW PIPELINE INTERTIE BYPASS FOR PLAN SEE SHEET C-25
LAKEVIEW PIPELINE
MWD FEE PROPERTY
MANHOLE W/ 1" AIR RELEASE AND 8" VACUUM VALVE (TYP)
MH SET 103
MH SET 104
VALVE STRUCTURE NO. 7
VALVE STRUCTURE NO. 6
PLAN
SCALE: 1" = 30'
NOTES:
1. FOR LEGEND, SEE SHEET C-1.
2. FOR ABBREVIATIONS AND GENERAL NOTES, SEE SHEET C-2.
3. ALL EXISTING SURFACE FEATURES AND UTILITIES SHALL BE PROTECTED IN PLACE, UNLESS NOTED OTHERWISE.
4. FOR DEMOLITION PLAN, SEE SHEET C-13.
5. FOR INLAND FEEDER PRESSURE CONTROL STRUCTURE FINISHED GRADING AND SITE RESTORATION PLAN, SEE SHEET C-17.
6. FOR GRADING, DRAINAGE AND EROSION CONTROL PLAN FOR LAKEVIEW PIPELINE INTERTIE, SEE SHEET C-19.
7. FOR LOAD RESTRICTIONS, SEE SECTION 01540 OF THE WRITTEN SPECIFICATIONS.
ISSUE DESCRIPTION
ADDENDUM 1
ADDED LAKEVIEW PIPELINE, MH W/ 1" AIR RELEASE VALVE AND 8" VACUUM VALVE
ISSUE DATE MAY 2014
MWD METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA
FOR DRAWING APPROVALS SEE
B-146058
CONVEYANCE SYSTEM
LAKEVIEW PIPELINE
INLAND FEEDER AND LAKEVIEW PIPELINE INTERTIE
INLAND FEEDER PC-1 AND LAKEVIEW PIPELINE INTERTIE
OVERALL YARD PIPING PLAN
SPECIFICATIONS 1787
PROJECT NUMBER 104614
SHEET C-21
DWG B-146069
REV 1
SCALE BARS
1" = 30' 0 30 60 90 FEET
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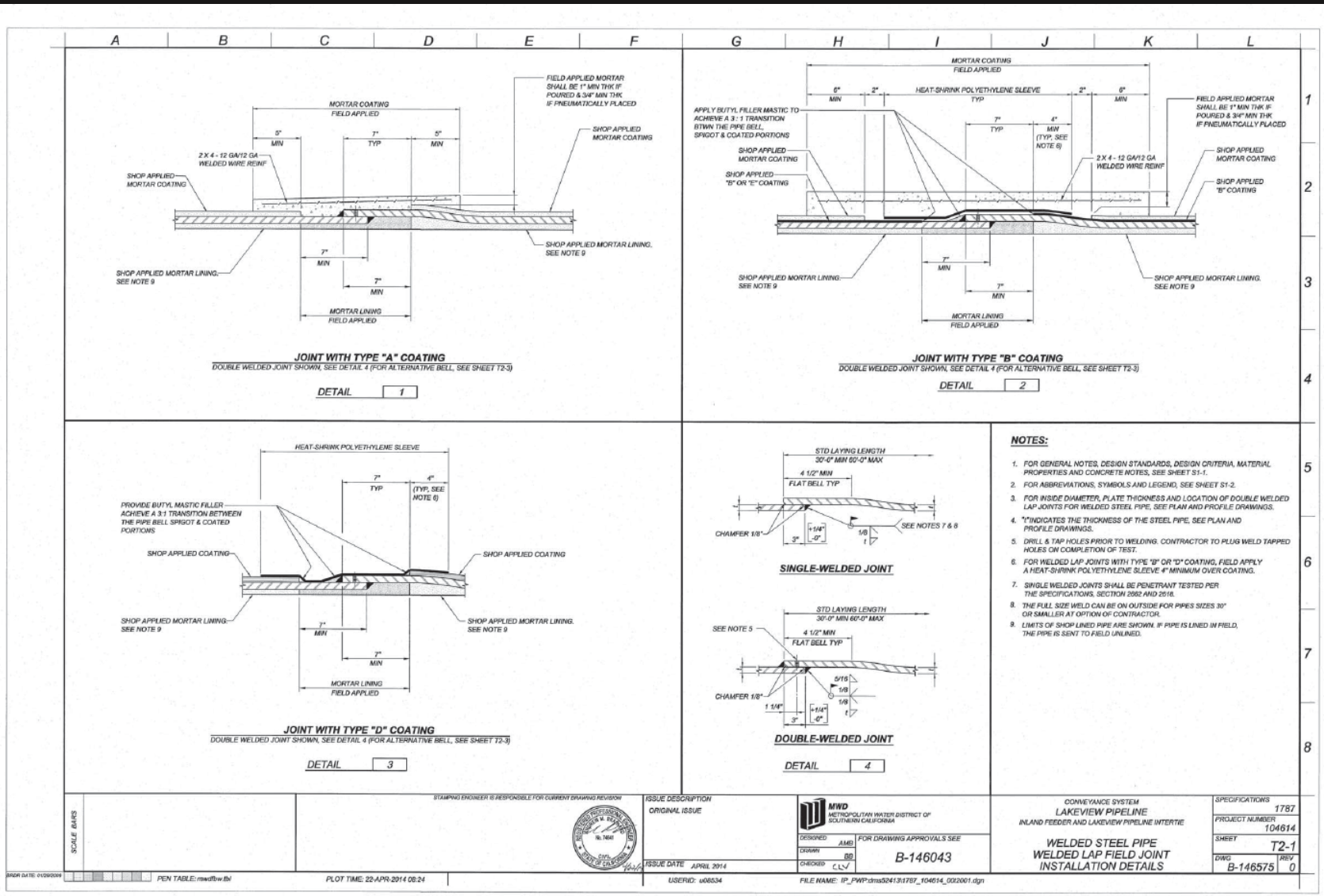
MORTAR COATING
FIELD APPLIED
FIELD APPLIED MORTAR SHALL BE 1" MIN THK IF POURED & 3/4" MIN THK IF PNEUMATICALLY PLACED
SHOP APPLIED MORTAR COATING
2 X 4 - 12 GA/12 GA WELDED WIRE REINF
SHOP APPLIED MORTAR COATING
SHOP APPLIED MORTAR LINING, SEE NOTE 9
SHOP APPLIED MORTAR LINING, SEE NOTE 9
MORTAR LINING FIELD APPLIED
JOINT WITH TYPE "A" COATING
DOUBLE WELDED JOINT SHOWN, SEE DETAIL 4 (FOR ALTERNATIVE BELL, SEE SHEET T2-3)
DETAIL 1
HEAT-SHRINK POLYETHYLENE SLEEVE
APPLY BUTYL FILLER MASTIC TO ACHIEVE A 3 : 1 TRANSITION BTWN THE PIPE BELL, SPIGOT & COATED PORTIONS
SHOP APPLIED "B" OR "E" COATING
SHOP APPLIED "B" COATING
JOINT WITH TYPE "B" COATING
DETAIL 2
PROVIDE BUTYL MASTIC FILLER ACHIEVE A 3:1 TRANSITION BETWEEN THE PIPE BELL SPIGOT & COATED PORTIONS
SHOP APPLIED COATING
JOINT WITH TYPE "D" COATING
DETAIL 3
STD LAYING LENGTH 30'-0" MIN 60'-0" MAX
4 1/2" MIN FLAT BELL TYP
CHAMFER 1/8"
SEE NOTES 7 & 8
SINGLE-WELDED JOINT
SEE NOTE 5
DOUBLE-WELDED JOINT
DETAIL 4
NOTES:
1. FOR GENERAL NOTES, DESIGN STANDARDS, DESIGN CRITERIA, MATERIAL PROPERTIES AND CONCRETE NOTES, SEE SHEET S1-1.
2. FOR ABBREVIATIONS, SYMBOLS AND LEGEND, SEE SHEET S1-2.
3. FOR INSIDE DIAMETER, PLATE THICKNESS AND LOCATION OF DOUBLE WELDED LAP JOINTS FOR WELDED STEEL PIPE, SEE PLAN AND PROFILE DRAWINGS.
4. "t" INDICATES THE THICKNESS OF THE STEEL PIPE, SEE PLAN AND PROFILE DRAWINGS.
5. DRILL & TAP HOLES PRIOR TO WELDING. CONTRACTOR TO PLUG WELD TAPPED HOLES ON COMPLETION OF TEST.
6. FOR WELDED LAP JOINTS WITH TYPE "B" OR "D" COATING, FIELD APPLY A HEAT-SHRINK POLYETHYLENE SLEEVE 4" MINIMUM OVER COATING.
7. SINGLE WELDED JOINTS SHALL BE PENETRANT TESTED PER THE SPECIFICATIONS, SECTION 2662 AND 2618.
8. THE FULL SIZE WELD CAN BE ON OUTSIDE FOR PIPES SIZES 30" OR SMALLER AT OPTION OF CONTRACTOR.
9. LIMITS OF SHOP LINED PIPE ARE SHOWN. IF PIPE IS LINED IN FIELD, THE PIPE IS SENT TO FIELD UNLINED.
ISSUE DESCRIPTION
ORIGINAL ISSUE
ISSUE DATE APRIL 2014
MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA
DESIGNED AMB
DRAWN BB
CHECKED CLV
FOR DRAWING APPROVALS SEE
B-146043
CONVEYANCE SYSTEM
LAKEVIEW PIPELINE
INLAND FEEDER AND LAKEVIEW PIPELINE INTERTIE
WELDED STEEL PIPE
WELDED LAP FIELD JOINT
INSTALLATION DETAILS
SPECIFICATIONS 1787
PROJECT NUMBER 104614
SHEET T2-1
DWG B-146575
REV 0
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JULY, 2008

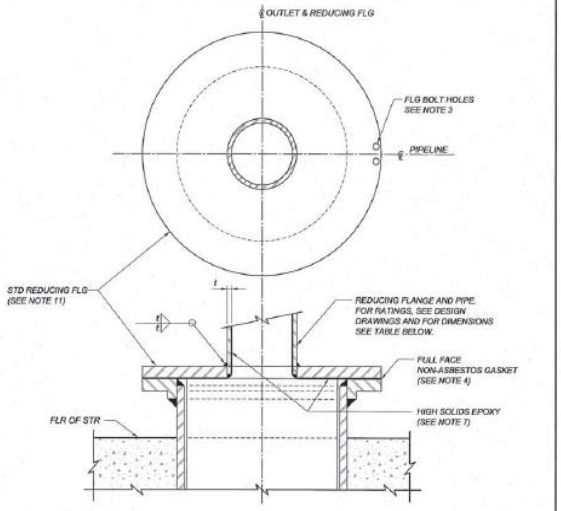

TABLE FOR PIPE SIZE		
SIZE OF PIPE	SCH. NO.	"t"
4"	STD	.237"
6"	STD	.280"
8"	STD	.322"
10"	STD	.375"
12"	STD	.375"

REDUCING FLANGE DETAIL FOR PIPE CONNECTION

DETAIL 1
SEE NOTES 10 & 12

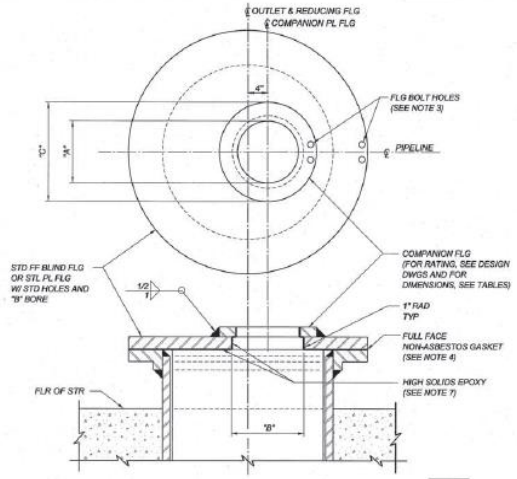

TABLE FOR VALVE CONNECTION FOR 150# FLANGE							
SIZE OF VALVE	"A"	"B"	REDUCING PLATE FLANGE DIMENSIONS				
			OD "C"	THICKNESS	NO OF HOLES DRILL AND TAP	SIZE OF STUDS AND NUTS	BOLT CIRCLE
4"	4"	5"	9"	15/16"	8	5/8"	7 1/2"
6"	6"	7"	11"	1"	8	3/4"	9 1/2"
8"	8"	9"	13 1/2"	1 1/8"	8	3/4"	11 3/4"
10"	10"	11"	16"	1 3/16"	12	7/8"	14 1/4"
12"	12"	13"	19"	1 1/4"	12	7/8"	17"

TABLE FOR VALVE CONNECTION FOR 300# FLANGE							
SIZE OF VALVE	"A"	"B"	REDUCING PLATE FLANGE DIMENSIONS				
			OD "C"	THICKNESS	NO OF HOLES DRILL AND TAP	SIZE OF STUDS AND NUTS	BOLT CIRCLE
4"	4"	5"	10"	1 1/4"	8	3/4"	7 7/8"
6"	6"	7"	12 1/2"	1 7/16"	12	3/4"	10 5/8"
8"	8"	9"	15"	1 5/8"	12	7/8"	13"
10"	10"	11"	17 1/2"	1 7/8"	16	1"	15 1/4"
12"	12"	13"	20 1/2"	2"	16	1 1/8"	17 3/4"

COMPANION FLANGE DETAIL FOR VALVE CONNECTION

DETAIL 2
SEE NOTES 10 & 12

NOTES:

1. FOR GENERAL NOTES, DESIGN STANDARDS, DESIGN CRITERIA, MATERIAL PROPERTIES AND CONCRETE NOTES, SEE SHEET S1-1.
2. FOR ABBREVIATIONS, SYMBOLS AND LEGEND, SEE SHEET S1-2.
3. ALL MANHOLE FLANGES, OUTLET FLANGES AND BLIND FLANGES SHALL BE FLAT FACED, BOLT HOLES TO STRADDLE CENTER LINE OF PIPELINE.
4. ALL GASKETS SHALL BE FULL FACED. PROVIDE SERRATIONS ON FLAT FACE FLANGES PER SPECIFICATIONS.
5. "t" INDICATES THE THICKNESS OF THE STEEL PIPE.
6. IN LIEU OF FLANGED THIMBLES FABRICATED FROM PIPE AND SEPARATE FLANGES AS SHOWN, CONTRACTOR MAY FURNISH FORGED STEEL NOZZLES OF REQUIRED ANSI RATING FOR MANHOLES AND OUTLET ASSEMBLIES. ALL MANHOLE AND OUTLETS SHALL BE 30" OD UNLESS NOTED OTHERWISE.
7. HIGH SOLIDS EPOXY ON SURFACES NOT COVERED BY NON-ASBESTOS GASKET.
8. TAPPED HOLES IN FLANGES SHALL BE A CLASS 3 FIT.
9. ALL BOLT HOLES TO BE SPOT FACED.
10. WHEN COMPANION FLANGES ARE REQUIRED FOR AIR RELEASE AND/OR VACUUM VALVE AND/OR PUMPING WELL STRUCTURES, THE 1:5 MORTAR CAP SHALL COVER COMPANION FLANGE, STUDS AND NUTS. SEE SHEET T2-8.
11. CUTTING A HOLE IN A STANDARD BLIND FLANGE IS NOT ACCEPTABLE. A STANDARD REDUCING FLANGE, PRESSURE RATED FOR THE DESIGN PRESSURE SHALL BE PROVIDED.
12. MORTAR CAP NOT SHOWN. SEE T2-8 FOR DETAILS OF MORTAR CAP.
13. TABLE APPLIES FOR ISO 150# AND 300# FLANGES

SCALE BARS

STAMPING ENGINEER IS RESPONSIBLE FOR CURRENT DRAWING REVISION

ISSUE DESCRIPTION
ORIGINAL ISSUE
ISSUE DATE APRIL 2014

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED AMB
DRAWN BB
CHECKED CLV

FOR DRAWING APPROVALS SEE
B-146043

CONVEYANCE SYSTEM
LAKEVIEW PIPELINE
INLAND FEEDER AND LAKEVIEW PIPELINE INTERTIE

WELDED STEEL PIPE
REDUCING AND COMPANION FLANGES
TYPICAL DETAILS

SPECIFICATIONS 1787
PROJECT NUMBER 104614
SHEET T2-9
DWG B-146583
REV 0

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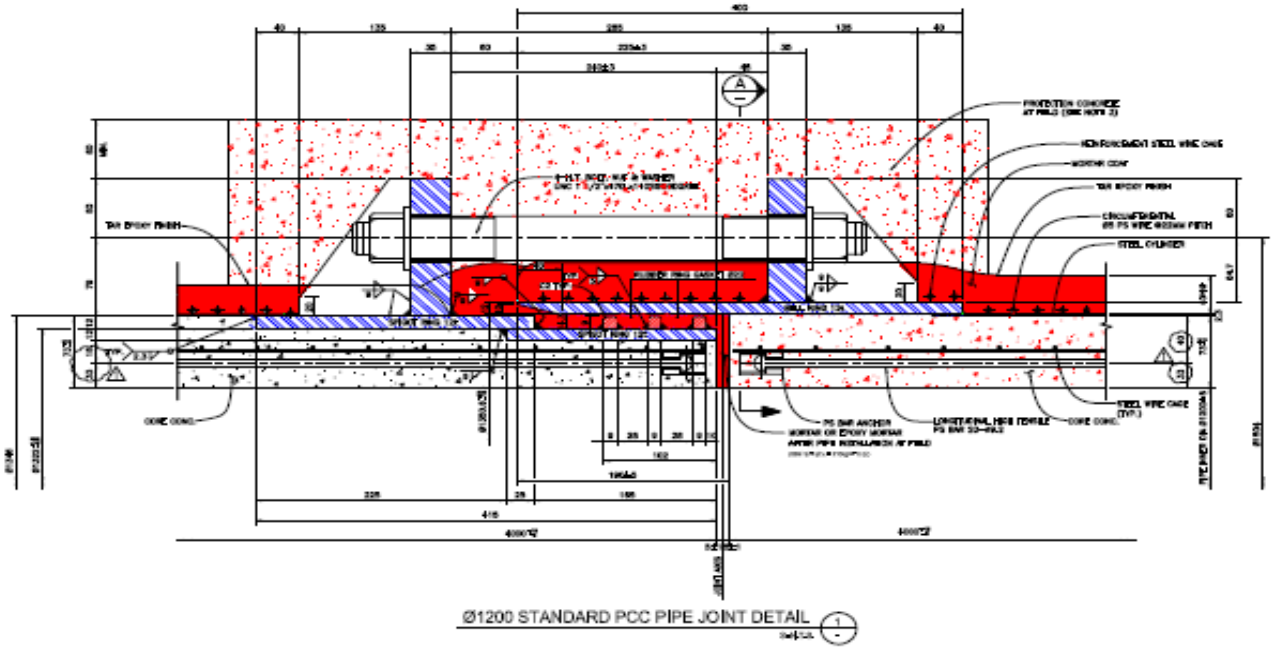
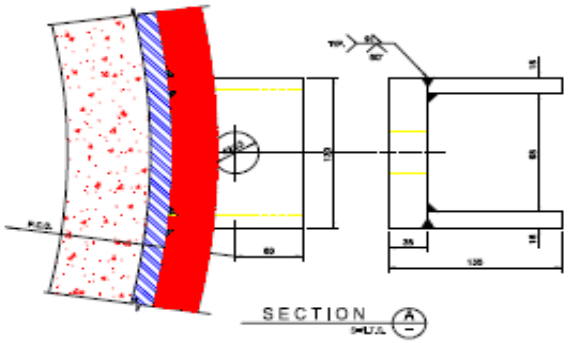
JULY, 2006



Ø1200 STANDARD PCC PIPE JOINT DETAIL



SECTION

MATERIAL LIST

NO.	ITEMS	SIZE	STANDARD	REMARKS
1	STEEL CYLINDER	–	KS D3503 SS400	CYLINDER BARREL (STRAIGHT PIPE)
2	STEEL PLATE	12T~25T	KS D3503 SS400	SPIGOT, BELL, SPIGOT & BELT BARRELING
3	HIGH TENSILE PS BAR	Ø5	ASTM A648, CLASS#, # GRADE	
4	RUBBER RING GASKET	Ø22	KS M6515 CLASS 1	
5	ST. BOLT NUT & WASHER	11/2"×4½L×1EA	BOLT : KS D3507 SCM435 NUT : KS D3507 SCM435 WASHER : KS D3503 SS400	HEAT TREATED
6	PS BAR ANCHER	Ø6.2	–	
7	CEMENT	–	ASTM C150 TYPE I	
8	HIGH TENSILE PS BAR	Ø6.2	KS D3505 SWPA SWPD 1275/1420	SCDA
9	MORTAR	–	f'ck=280 kg/cm²	6000AYS
10	PROTECTION CONCRETE	–	fck=140 kg/cm², W/C%	6000AYS
11	CORE CONCRETE	–	fck=500 kg/cm²	6000AYS
12	REINFORCEMENT STEEL WIRE CAGE	Ø5.0	ASTM A185 SRW 500/515 WWR 70x70	
13	TAR EPOXY PAINTED	–	KS F4021	

NOTE

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. EXPOSED SURFACE OF BELL AND SPIGOT PART SHALL BE APPLIED TO TAR EPOXY COATING AT FIELD.
3. CONCRETE FOR OUTER PROTECTION AT FIELD IS PCP-C1 TYPE A1 OR A2
4. [illegible]

MARK	NO.	DESCRIPTION	DESIGNED	DRAWN	TRACED	CHECKED
△						
△						
△	2014.02.28	GENERAL REVISION				
△	2013.08.16	FIRST ISSUE	이다솜	남궁구	이다솜	이재무
BY	DES	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

KOREA HYDRO & NUCLEAR POWER CO., LTD
SHIN-KORI NUCLEAR POWER PLANT UNITS 1&2

HYUNDAI ENGINEERING & CONSTRUCTION CO., LTD
SK ENGINEERING & CONSTRUCTION CO., LTD
GS ENGINEERING & CONSTRUCTION CO., LTD

TYPICAL JOINT DETAIL FOR Ø1200 P.S.P. DOUBLE PCC STANDARD PIPES

SCALE	DATE	REF. DRAWING NO.
SR	NON SCALE	0-047-C132-001
	2013. 08. 19	0-047-C132-002

DRAWING NO. 0-047-D-132-D-P19-004 | SHEET NO. 1 OF 1 | REV. NO. 1

Structural design

계 산 서
CALCULATION SHEET

사업번호
JOB NO.

계산서번호 CALC. NO. JK-C1207-E-14-001 | 개정번호 REV. NO. 2 | 페이지 SHEET 1 OF 109

1. INTRODUCTION

This calculation covers the analysis and design of ϕ1200mm LCP (Lined Cylinder Pipe) type Prestressed Concrete Cylinder Pipe (PCCP) for ESW discharge system of Shin Ulchin Nuclear (SUN) Units 1 & 2.

2. REFERENCES

1) Technical Specification : No. 9 - 192 - C292 - Rev. 0, SUN 1&2 D7-Attachment 1, Prestressed Concrete - Steel Cylinder Pipe (CFM Spec. No. 9-112-C211)

2) KEPCO E&C's Design Drawings :

0-247-C132-001, Rev. 2 'ESW DISCHARGE PIPELINE PLAN', SUN 1&2
0-247-C132-002, Rev. 2 'ESW DISCHARGE PIPELINE SECTIONS & DETAILS', SUN 1&2

3) BC-TOP-4 Rev. 4 (1980), 'Seismic Analysis of Structures and Equipment for Nuclear Power Plants'

4) SDS-E24.4 Rev. 1 (1986), 'Buried Pipe'

5) SUN #1,2 PSAR(Preliminary Safety Analysis Report)

3. APPLICABLE CODES AND STANDARDS

1) ANSI/AWWA C301-99, 'Prestressed Concrete Pressure Pipe, Steel-Cylinder Type'

2) ANSI/AWWA C304-99, 'Design of Prestressed Concrete Cylinder Pipe'

3) AWWA Manual M9 2nd Edition (1995), 'Concrete Pressure Pipe'

4) ASCE 4-98, 'Seismic Analysis of Safety-Related Nuclear Structures and Commentary'

5) KS D 7009-1997, 'Hard Drawn Steel for Prestressed Concrete'

6) KS D 3505-2002, 'Steel Bars for Prestressed Concrete'

7) KS D 3503-2008, 'Rolled Steels for General Structures'

8) KS D 3867-2007, 'Low Alloyed Steels for Machine Structural Use'

9) KS D 3752-2007, 'Carbon Steel for Machine Structural Use'

JACE KOREA

Structural design

계 산 서
CALCULATION SHEET

사업번호
JOB NO.

계산서번호 CALC. NO. JK-C1207-E-14-001 개정번호 REV. NO. 2 페이지 SHEET 2 OF 109

4. DESIGN PARAMETERS

Units :

$psi := \frac{lbf}{in^2}$ $pcf := \frac{lbf}{ft^3}$ $psf := \frac{lbf}{ft^2}$

$ksi := 1000 \cdot psi$ $kips := 1000 \cdot lbf$ $tonf := 1000 \cdot kgf$ $N := 1 \cdot kg \cdot \frac{m}{sec^2}$

4.1 Control Dimension of Pipe

- Grade elevation : $H_{GL} := 99 \cdot ft + 2 \cdot in$ $H_{GL} = 99.17 \cdot ft$
- Pipe center elevation (horiz. pipe) : $H_{pipe} := 71ft$
- Inside diameter of pipe : $D_i := 1200 \cdot mm$ $D_i = 47.24 \cdot in$
- Concrete Core thickness : $h_{cn} := 73 \cdot mm$ $h_{cn} = 2.874 \cdot in$
  : the core thickness excluding the steel cylinder thickness
- Mortar Coat thickness : $t_{co} := 40 \cdot mm$ $t_{co} = 1.575 \cdot in$
- Wrapping PS wire diameter : $d_s := 5 \cdot mm$ $d_s = 0.197 \cdot in$
- Wrapping PS wire pitch : $s := 22 \cdot mm$ $s = 0.866 \cdot in$

  check; $2 \cdot d_s = 0.39 \cdot in < s = 0.87 \cdot in < 1.5 \cdot in$ ==> O.K.
- Longitudinal PS bar diameter : $d_{sl} := 9.2 \cdot mm$ $d_{sl} = 0.362 \cdot in$
- Steel cylinder thickness : $t_y := 2.3 \cdot mm$ $t_y = 0.091 \cdot in$
- Outside diameter of pipe : $D_o := D_i + 2 \cdot (h_{cn} + t_y + t_{co})$ $D_o = 56.32 \cdot in$
- Outside diameter of cylinder : $D_y := D_i + 2 \cdot (h_{cn} + t_y)$ $D_y = 53.17 \cdot in$
- Center Radius of pipe : $R_c := \frac{(D_i + h_{cn} + t_y + t_{co})}{2}$ $R_c = 25.892 \cdot in$

JACE KOREA

Structural design

계 산 서
CALCULATION SHEET

사업번호
JOB NO.

계산서번호 CALC. NO. JK-C1207-E-14-001 개정번호 REV. NO. 2 페이지 SHEET 4 OF 109

4.2 Materials and Sectional Properties of Pipe

$h_c := h_{cn} + t_y$: the core thickness including the cylinder thickness $h_c = 75.3 \cdot mm$

$b := 12 \cdot in$

1) PS Wire : KS D 7009 Type SWCR

- Unit weight : $\gamma_s := 490 \cdot pcf$
- Specified min. tensile strength : $f_{su} := 1520 \cdot \frac{N}{mm^2}$ $f_{su} = 220 \cdot ksi$
- Yield strength : $f_{sy} := 0.85 \cdot f_{su}$ $f_{sy} = 187 \cdot ksi$
- Modulus of elasticity : $E_s := 28 \cdot 10^6 \cdot psi$
- Gross wrapping stress : $f_{sg} := 0.75 \cdot f_{su}$ $f_{sg} = 165 \cdot ksi$
- Strains : $\varepsilon_{sg} := \frac{f_{sg}}{E_s}$ $\varepsilon_{sg} = 5.905 \times 10^{-3}$

  $\varepsilon_{sy} := \frac{f_{sy}}{E_s}$ $\varepsilon_{sy} = 6.692 \times 10^{-3}$
- Area per linear foot : $A_s := \frac{\pi \cdot d_s^2}{4} \cdot \frac{b}{s}$ $A_s = 0.422 \cdot in^2$
- Wire dia. to core thickness ratio : $\lambda_s := \frac{d_s}{2 \cdot h_c}$ $\lambda_s = 0.033$

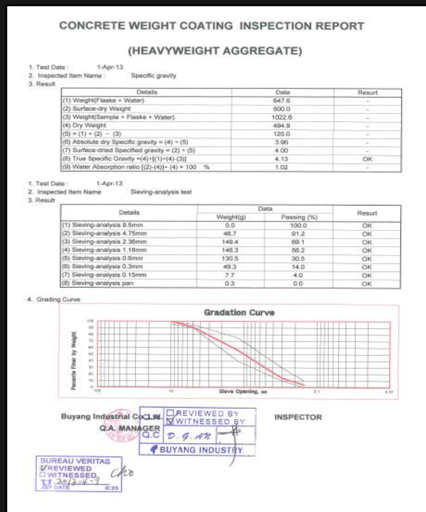
2) Cylinder : KS D3503 Type SS400

- Unit weight : $\gamma_s := 490 \cdot pcf$
- Yield strength : $f_y := 2400 \cdot \frac{kgf}{cm^2}$ $f_y = 34.14 \cdot ksi$
- Tensile Strength : $f'_y := 45 \cdot ksi$
- Modulus of elasticity : $E_y := 29 \cdot 10^6 \cdot psi$

JACE KOREA

BUYANG INDUSTRY

Inspection and Test Results (Cement & Water)



CONCRETE WEIGHT COATING INSPECTION REPORT

(HEAVYWEIGHT AGGREGATE)

1. Test Date : 1-Apr-13
2. Inspected Item Name : Specific gravity
3. Result

Details	Data	Result
(1) Weight(Flaske + Water)	647.6	-
(2) Surface-dry Weight	500.0	-
(3) Weight(Sample + Flaske + Water)	1022.6	-
(4) Dry Weight	494.9	-
(5) = (1) + (2) − (3)	125.0	-
(6) Absolute dry Specific gravity = (4) ÷ (5)	3.96	-
(7) Surface-dried Specified gravity = (2) ÷ (5)	4.00	-
(8) True Specific Gravity =(4)÷[(1)+(4)-(3)]	4.13	OK
(9) Water Absorption ratio [(2)-(4)]÷(4) × 100 %	1.02	-

1. Test Date : 1-Apr-13
2. Inspected Item Name : Sieving-analysis test
3. Result

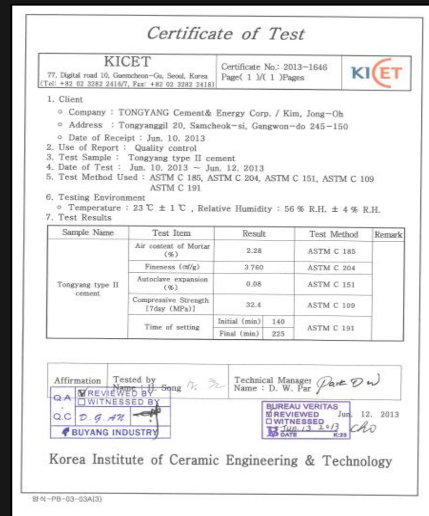
Details	Weight(g)	Passing (%)	Result
(1) Sieving-analysis 9.5mm	0.0	100.0	OK
(2) Sieving-analysis 4.75mm	46.7	91.2	OK
(3) Sieving-analysis 2.36mm	149.4	69.1	OK
(4) Sieving-analysis 1.18mm	146.3	56.2	OK
(5) Sieving-analysis 0.6mm	130.5	30.5	OK
(6) Sieving-analysis 0.3mm	49.3	14.0	OK
(7) Sieving-analysis 0.15mm	7.7	4.0	OK
(8) Sieving-analysis pan	0.3	0.0	OK

4. Grading Curve

Gradation Curve

Buyang Industrial Co., Ltd. Q.A. MANAGER

INSPECTOR



Certificate of Test

KICET

77, Digital road 10, Geumcheon-Gu, Seoul, Korea

Certificate No.: 2013−1646

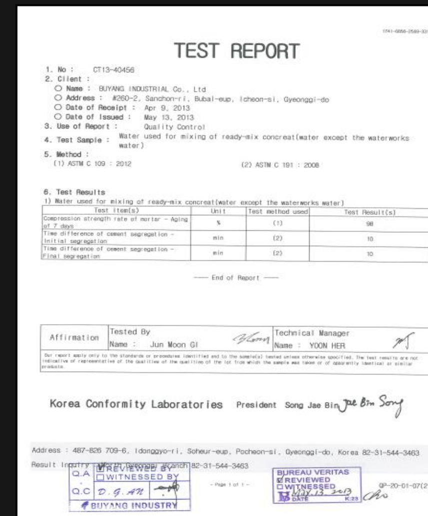
1. Client
   - Company : TONGYANG Cement& Energy Corp. / Kim, Jong−Oh
   - Address : Tongyanggil 20, Samcheok−si, Gangwon−do 245−150
   - Date of Receipt : Jun. 10. 2013
2. Use of Report : Quality control
3. Test Sample : Tongyang type II cement
4. Date of Test : Jun. 10. 2013 ~ Jun. 12. 2013
5. Test Method Used : ASTM C 185, ASTM C 204, ASTM C 151, ASTM C 109, ASTM C 191
6. Testing Environment
   - Temperature : 23 ℃ ± 1 ℃ , Relative Humidity : 56 % R.H. ± 4 % R.H.
7. Test Results

Sample Name	Test Item		Result	Test Method	Remark
Tongyang type II cement	Air content of Mortar (%)		2.28	ASTM C 185	
	Fineness (㎠/g)		3 760	ASTM C 204	
	Autoclave expansion (%)		0.08	ASTM C 151	
	Compressive Strength [7day (MPa)]		32.4	ASTM C 109	
	Time of setting	Initial (min)	140	ASTM C 191	
		Final (min)	225		

Affirmation — Tested by Name : U. Song — Technical Manager Name : D. W. Par

Jun. 12. 2013

Korea Institute of Ceramic Engineering & Technology



TEST REPORT

1. No : CT13-40456
2. Client :
   - Name : BUYANG INDUSTRIAL Co., Ltd
   - Address : #260-2, Sanchon-ri, Bubal-eup, Icheon-si, Gyeonggi-do
   - Date of Receipt : Apr 9, 2013
   - Date of Issued : May 13, 2013
3. Use of Report : Quality Control
4. Test Sample : Water used for mixing of ready-mix concreat(water except the waterworks water)
5. Method : (1) ASTM C 109 : 2012 (2) ASTM C 191 : 2008
6. Test Results

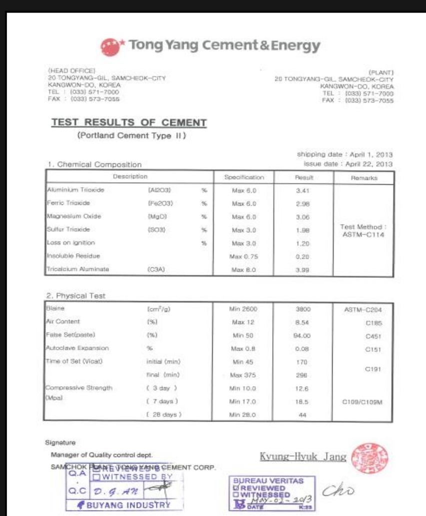
1) Water used for mixing of ready-mix concreat(water except the waterworks water)

Test item(s)	Unit	Test method used	Test Result(s)
Compression strength rate of mortar − Aging of 7 days	%	(1)	98
Time difference of cement segregation − Initial segregation	min	(2)	10
Time difference of cement segregation − Final segregation	min	(2)	10

— End of Report —

Affirmation — Tested By Name : Jun Moon Gi — Technical Manager Name : YOON HER

Korea Conformity Laboratories President Song Jae Bin



Tong Yang Cement & Energy

(HEAD OFFICE) 20 TONGYANG-GIL, SAMCHEOK-CITY KANGWON-DO, KOREA TEL : (033) 571-7000 FAX : (033) 573-7055

(PLANT) 20 TONGYANG-GIL, SAMCHEOK-CITY KANGWON-DO, KOREA TEL : (033) 571-7000 FAX : (033) 573-7055

TEST RESULTS OF CEMENT

(Portland Cement Type II)

shipping date : April 1, 2013
issue date : April 22, 2013

1. Chemical Composition

Description			Specification	Result	Remarks
Aluminum Trioxide	(Al2O3)	%	Max 6.0	3.41	Test Method : ASTM−C114
Ferric Trioxide	(Fe2O3)	%	Max 6.0	2.98	
Magnesium Oxide	(MgO)	%	Max 6.0	3.06	
Sulfur Trioxide	(SO3)	%	Max 3.0	1.98	
Loss on ignition		%	Max 3.0	1.20	
Insoluble Residue			Max 0.75	0.20	
Tricalcium Aluminate	(C3A)		Max 8.0	3.99	

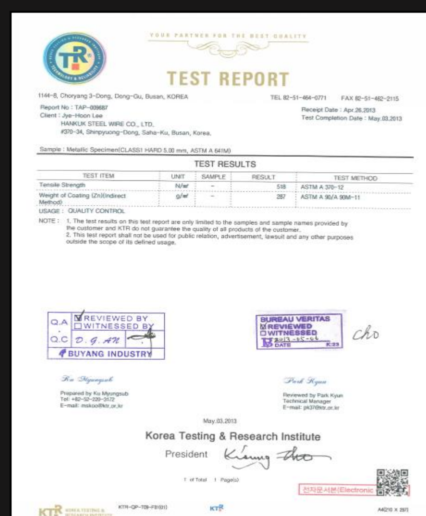
2. Physical Test

Description		Specification	Result	Remarks
Blaine	(cm²/g)	Min 2600	3800	ASTM−C204
Air Content	(%)	Max 12	8.54	C185
False Set(paste)	(%)	Min 50	94.00	C451
Autoclave Expansion	%	Max 0.8	0.08	C151
Time of Set (Vicat)	initial (min)	Min 45	170	C191
	final (min)	Max 375	296	
Compressive Strength (Mpa)	(3 day)	Min 10.0	12.6	C109/C109M
	(7 days)	Min 17.0	18.5	
	(28 days)	Min 28.0	44	

Signature

Manager of Quality control dept. Kyung-Hyuk Jang

SAMCHOK PLANT, TONG YANG CEMENT CORP.



YOUR PARTNER FOR THE BEST QUALITY

TEST REPORT

1144-8, Choryang 3-Dong, Dong-Gu, Busan, KOREA TEL 82-51-464-0771 FAX 82-51-462-2115

Report No : TAP-009687
Client : Jye-Hoon Lee HANKUK STEEL WIRE CO., LTD. #370-34, Shinpyoung-Dong, Saha-Ku, Busan, Korea.

Receipt Date : Apr.26.2013
Test Completion Date : May.03.2013

Sample : Metallic Specimen(CLASS1 HARD 5.00 mm, ASTM A 641M)

TEST RESULTS

TEST ITEM	UNIT	SAMPLE	RESULT	TEST METHOD
Tensile Strength	N/㎟	−	518	ASTM A 370−12
Weight of Coating (Zn)(Indirect Method)	g/㎡	−	287	ASTM A 90/A 90M−11

USAGE : QUALITY CONTROL

NOTE : 1. The test results on this test report are only limited to the samples and sample names provided by the customer and KTR do not guarantee the quality of all products of the customer.
2. This test report shall not be used for public relation, advertisement, lawsuit and any other purposes outside the scope of its defined usage.

Prepared by Ku Myongsub — Reviewed by Park Kyun, Technical Manager

May.03.2013

Korea Testing & Research Institute

President

Raw Materials Inspection and Test Results

Inspection and Test Results (Concrete weight)

Industry & Facilities Division — Page: 1/1

RELEASE NOTE N° 1140873-RN-01

BV Job nr : 3.30.2146

PROJECT: 10.4644 CHINESE PETROLEUM CORPORATION — Ref: N/A
BV Client: BUYANG INDUSTRY CO. — P/o nr: N/A (client to BV)
Manufacturer: BUYANG INDUSTRY CO. — P/o nr: 104644-VODMC-BYN-POA-001 (client to Manufacturer)
Inspection requested by: BUYANG INDUSTRY CO.

SUPPLY / SUBJECT OF INSPECTION	ITEM / TAG Nr	QTY
Concrete Weight coated pipes Concrete thickness 90mm	Refer to attached item lists	148PCS

CONCLUSIONS / REMARKS :

The following inspection has been carried out in accordance with the above applicable codes, standards, specifications and the results of inspection were found to be satisfactory.

-Review of mill sheet and test reports of raw materials.
-Review & endorsement of manufacturer's inspection certificates.
-Witness of visual and dimensional inspection for samples.
-Witness of the tests of cube specimens
(Density, 7day compressive strength, 28day compressive strength)

The above items have been released in accordance with specifications and purchase order requirements on hand at the vendor's premises at the time of inspection.

This note is issued further to an inspection whose duration and scope were limited by the terms and conditions of the contract with BV principal. This note is NOT an indication that the item(s) is (are) fit for any specific purpose and does not release the manufacturer, supplier and any party from their respective duty, guarantee, obligation and/or indemnity relating to, without limitation, patents, workmanship, materials, safety, performance in operation and/or reliability.

Inspected by: Name: Su-Yun Cho Signature: — Checked by: Name: N/A Signature:....
Date of issue: May. 2. 2013
Inspection centre: BV Korea
Distribution: ☐ CLIENT ▪ MANUFACTURER ☐

This note is subject to the General Conditions of Service of Bureau Veritas in force on the day of its issuance.

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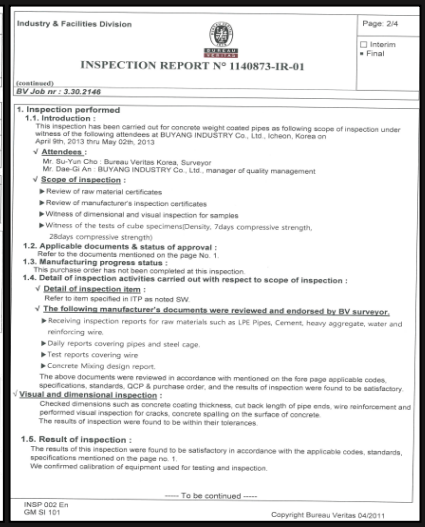

Industry & Facilities Division — Page: 2/4

INSPECTION REPORT N° 1140873-IR-01

(continued) BV Job nr : 3.30.2146

1. Inspection performed
1.1. Introduction :
This inspection has been carried out for concrete weight coated pipes as following scope of inspection under witness of the following attendees at BUYANG INDUSTRY Co., Ltd., Icheon, Korea on April 9th, 2013 thru May 02th, 2013
√ Attendees :
Mr. Su-Yun Cho : Bureau Veritas Korea, Surveyor
Mr. Dae-Gi An : BUYANG INDUSTRY Co., Ltd., manager of quality management
√ Scope of inspection :
▶ Review of raw material certificates
▶ Review of manufacturer's inspection certificates
▶ Witness of dimensional and visual inspection for samples
▶ Witness of the tests of cube specimens(Density, 7days compressive strength, 28days compressive strength)
1.2. Applicable documents & status of approval :
Refer to the documents mentioned on the page No. 1.
1.3. Manufacturing progress status :
This purchase order has not been completed at this inspection.
1.4. Detail of inspection activities carried out with respect to scope of inspection :
√ Detail of inspection item :
Refer to item specified in ITP as noted SW.
√ The following manufacturer's documents were reviewed and endorsed by BV surveyor.
▶ Receiving inspection reports for raw materials such as LPE Pipes, Cement, heavy aggregate, water and reinforcing wire.
▶ Daily reports covering pipes and steel cage.
▶ Test reports covering wire
▶ Concrete Mixing design report.
The above documents were reviewed in accordance with mentioned on the fore page applicable codes, specifications, standards, QCP & purchase order, and the results of inspection were found to be satisfactory.
√ Visual and dimensional inspection :
Checked dimensions such as concrete coating thickness, cut back length of pipe ends, wire reinforcement and performed visual inspection for cracks, concrete spalling on the surface of concrete.
The results of inspection were found to be within their tolerances.
1.5. Result of inspection :
The results of this inspection were found to be satisfactory in accordance with the applicable codes, standards, specifications mentioned on the page no. 1.
We confirmed calibration of equipment used for testing and inspection.

----- To be continued -----

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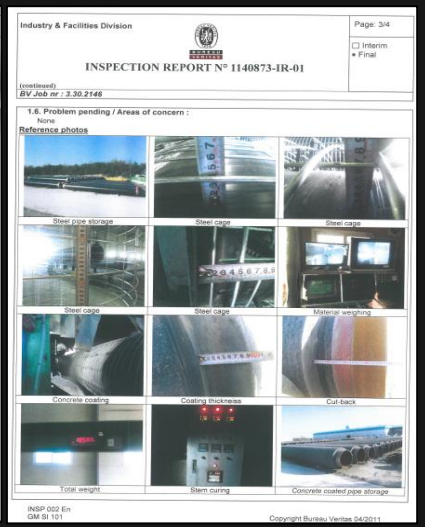

Industry & Facilities Division — Page: 3/4

INSPECTION REPORT N° 1140873-IR-01

(continued) BV Job nr : 3.30.2146

1.6. Problem pending / Areas of concern :
None
Reference photos

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Industry & Facilities Division — Page: 4/4

INSPECTION REPORT N° 1140873-IR-01

(continued) BV Job nr : 3.30.2146

Reference photos

ANNEXES ☐ Yes (Total number of pages: 4) ☐ No

Inspected by: Name: Su-Yun Cho Signature: — Checked by: Name: Signature:....
Date of issue: May. 2. 2013
Inspection centre: BV Korea
Distribution: ☐ CLIENT ▪ MANUFACTURER ☐

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Industry & Facilities Division — Page: 1/4

INSPECTION REPORT N° 1140873-IR-02

BV Job nr : 3.30.2146

PROJECT: 10.4644 CHINESE PETROLEUM CORPORATION — Ref: N/A
BV Client: BUYANG INDUSTRY CO.,LTD — P/o nr: N/A (client to BV)
Manufacturer: BUYANG INDUSTRY CO.,LTD — P/o nr: 104644-VODMC-BYN-POA-001 (client to Manufacturer)
Inspection requested by: BUYANG INDUSTRY CO.,LTD

SUPPLY / SUBJECT OF INSPECTION	ITEM / TAG Nr	QTY
Concrete Weight coated pipes Concrete thickness 130mm	Refer to attached item lists	250PCS
Push off test sample Concrete thickness 90mm		1PC

DOCUMENTS OF REFERENCE : See continuation sheet for additional documents ☐ Yes ☐ No

Title	Reference n°	Rev.	Approved by	Date
Project spec	ASTM			
Inspection and Test Plan	GPC-TOR-M003, BYI-D-104	1		
Concrete Weight Coating Procedure	ASTM	1		2013.03
Purchase Order				

INSPECTIONS :
Inspection place & Date or Period:
Stage of inspection : ☐ Before manufacturing ▪ During manufacturing ▪ Final ☐ Packing
Type of inspection: ☐ Pre-inspection meeting ▪ Document and QC record review ▪ Visual examination, checks ▪ Witnessing tests ☐ Manufacturing progress status ☐ Vendor assessment ▪ Final inspection ☐ Packing (for details see continuation sheet)
Stamping : ▪ No ☐

Results of inspection : ▪ Satisfactory ☐ Unsatisfactory
Non Conformities Reports (NCR): ☐ NCR is issued during reported period : NONE ☐ List of outstanding NCR's : NONE
Main Conclusions & Remarks: (for details see continuation sheet)
The following inspection has been carried out in accordance with the above applicable codes, specifications, standards, and the results of inspection were found to be satisfactory.
-Review of mill sheet and test reports of raw materials.
-Review & endorsement of manufacturer's inspection certificates.
-Witness of visual and dimensional inspection for samples.
-Witness of the tests of cube specimens (Density, 7 day compressive strength, 28 day compressive strength)
- Witness of push off test
Next visit scheduled:

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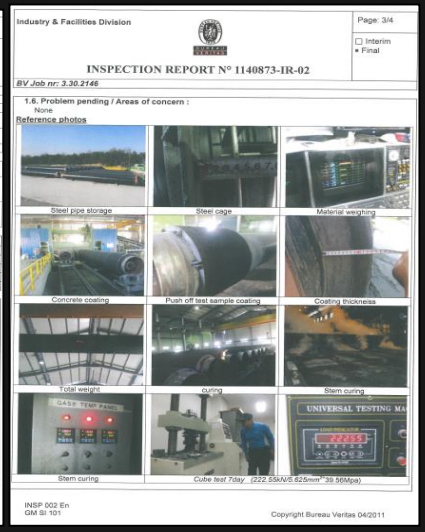


Industry & Facilities Division — Page: 3/4

INSPECTION REPORT N° 1140873-IR-02

BV Job nr: 3.30.2146

1.6. Problem pending / Areas of concern :
None
Reference photos

INSP 002 En GM SI 101 — Copyright Bureau Veritas 04/2011

Process Flow Diagram

① Incoming pipe

② Visual inspection
(Ovality, PE coating)

③ Incoming pipe to the shop

④ Spec. check-up

⑤ Steel cage Insert

⑥ Spacer installation

⑦ C. Weight Coating

⑧ Shop inspection

⑨ Steam curing

⑩ Final inspection (repair, ovality)

⑪ Transfer to the yard

⑫ Pipe release

Inspection

Step nut test for toehold

Dimension check

Compressive strength test

Bending strength test

Reinforcement check

Breaking check

Manufacturing

Buyang operates two shops equipped with six overhead cranes and advanced construction facilities in order to maximize the efficiency of its heavy-duty machinery.

Inspection

Buyang completes the inspection for ongoing material stocking, production process, final production, and before shipment. As such, Buyang prioritizes product and service quality.

PLANT

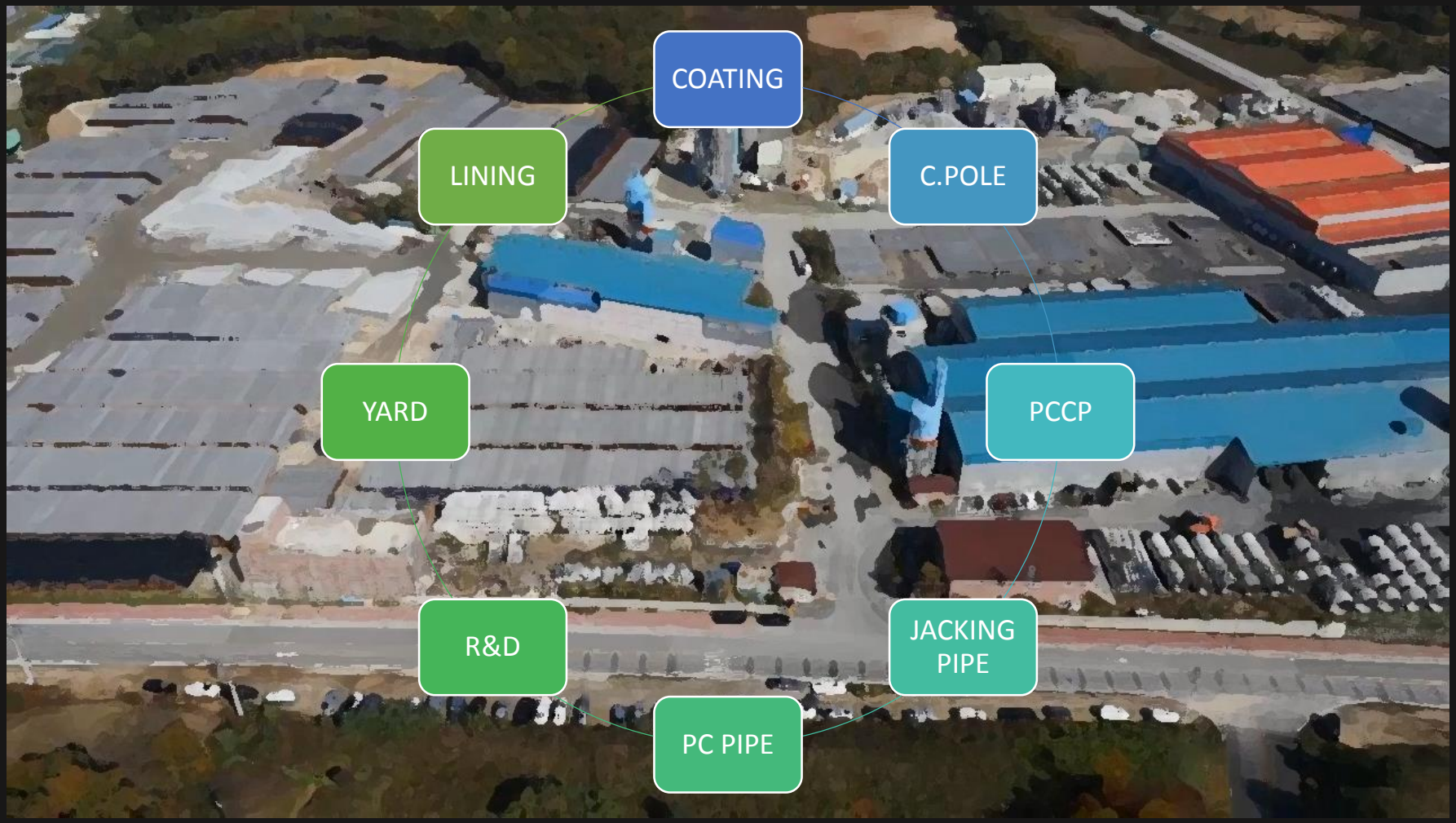
Delivery

Buyang assigns the delivery schedule to the shipping company for a safe and on-time product delivery.

After Service

Buyang Industry visits the site after delivery and gains the customer's trust by providing product satisfaction and technical support.

Current Status of Plant Facilities



General Information

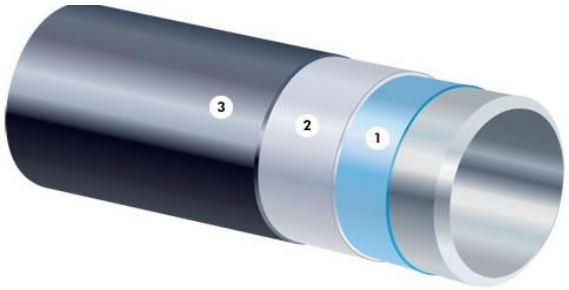
Shop	2 EA
Building	20,400 ㎡
Yard	85,100 ㎡
Overhead Cranes	18 EA
Gentry Cranes	2 EA
Forklift	4 EA
Others	Mobile Crane 1 Trailer 4 Push Off Test Machine 1 Impact Test Machine 1

Pipe Coating Capability

Concrete Weight Coating	Coating Machine : 1 set Cap. : 200,000 tons/year We can increase the number of machines anytime.	
P.E. Coating	However, Buyang is able to operate and set up the machine overseas if required. Available: FBE, 3LPE, 3LPP	

Pipe Coating Capability (CWC)

Coating Type	Impingement
Mixture Type	Dry
Reinforcement	Steel Cage
Curing	Steam
Speed	OD 48” x 130mm(THK) : 50 joints/10 hrs
Anode	Supply & Installation



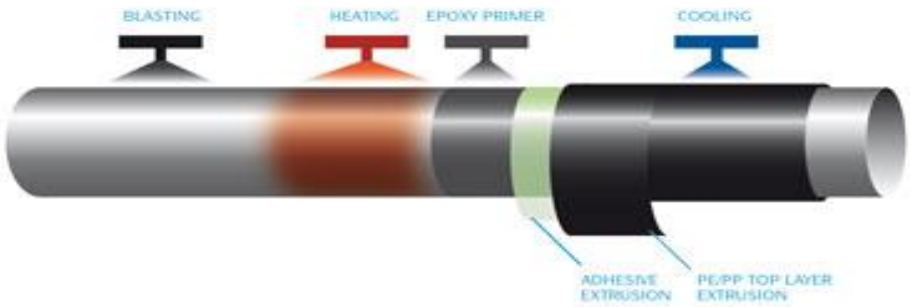
1. Fusion Bonded Epoxy
2. Copolymer Adhesive
3. Polyethylene

.

3 Layer PE Coating

3 Layer PE Coating provides excellent protection of steel line pipes to be used for transportation of Gas, Oil and Water from corrosion, impact.

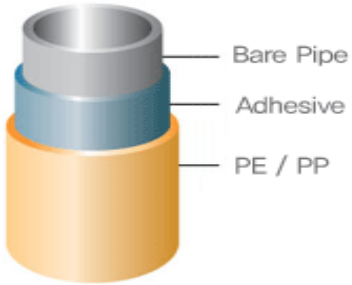
It consists of Fusion bonded epoxy, copolymer adhesive and polyethylene or polypropylene



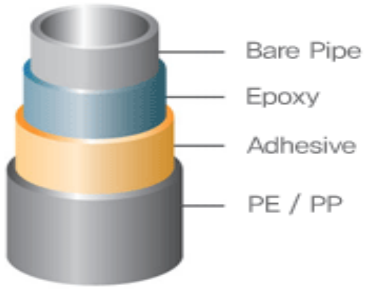
3LPE system is a multilayer coating composed of three functional components.

This anti corrosion system consists of a high performance fusion bonded epoxy (FBE) followed by a polyethylene which provides tough, durable protection.

3LPE System provide excellent pipeline protection for small and large diameter pipelines with moderate to high operating temperatures
.



[2–LAYER]



[3–LAYER]

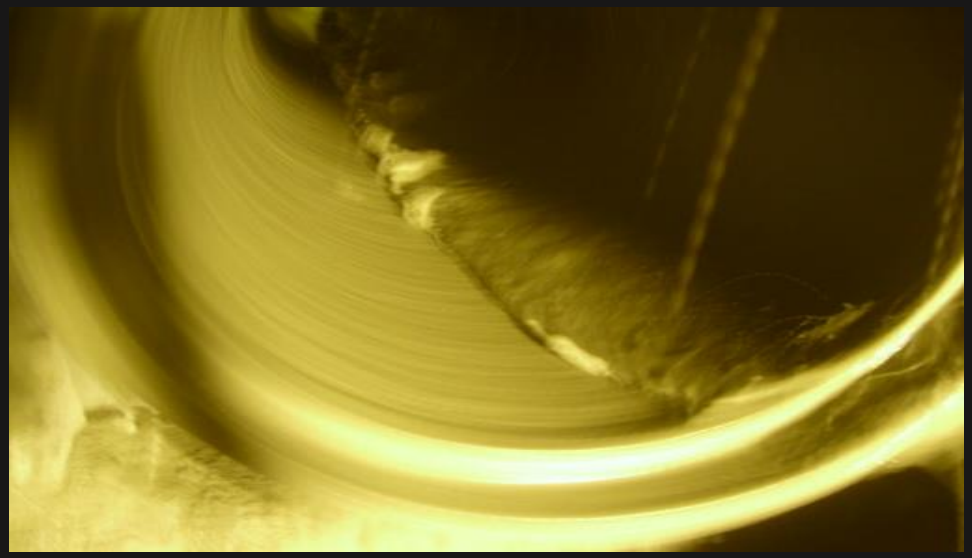
Jacking & PC Pipe Capability

Jacking Pipe	Outer Diameter : 500~ 3,000mm Cap. : min 2~max 20 pcs/day We can increase the number of pipes anytime.
P.C Pipe	Outer Diameter : 500~ 3,000mm Cap. : min 2~max 30 pcs/day We can increase the number of pipes anytime.

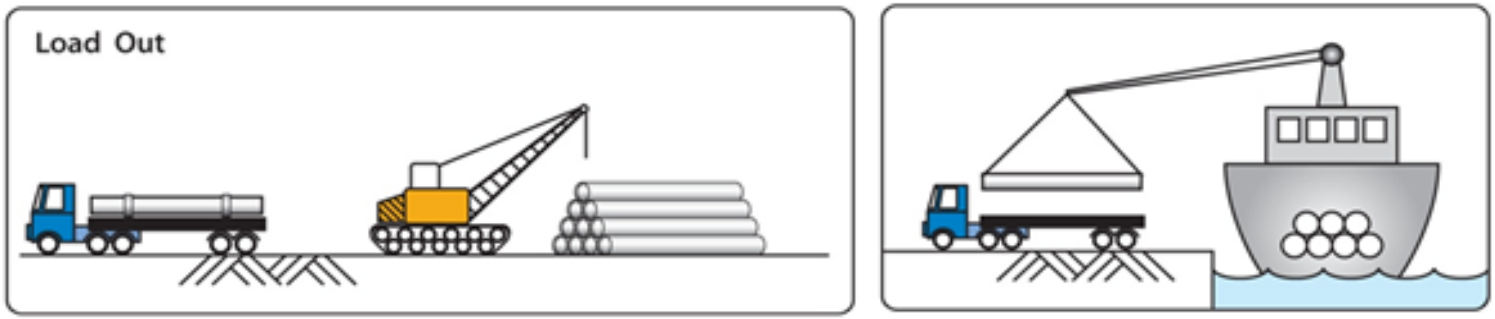
Straight Pipe	Outer Diameter 100mm ~ 4,000mm Cap,: max. 1,000 pcs/year We can increase the number of Pipes anytime.	
Bend Pipe	Outer Diameter 100mm ~ 4,000mm Cap.: max. 1,000 pcs/year We can increase the number of Pipes anytime.	

Concrete Pole & Lining Capability

Internal Coating (Lining)	Lining Machine : 1 set Cap. : 100,000 tons/year We can increase the number of machines anytime.
Concrete Pole	Length : 8m ~ 22m Compression Strength: 500 - 1,200 kgf/cm^2 Cap. min. 10,000pcs/year max. 100,000pcs/year We can increase the number of poles anytime.



- Inland Transportation
- Incoming Inspection
- Anode Inspection & Installation
- Cage Installation
- Concrete Coating
- Weighing & Cleaning
- Transportation & Shipment



- Inland Transportation
- Incoming Inspection
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- Concrete Coating
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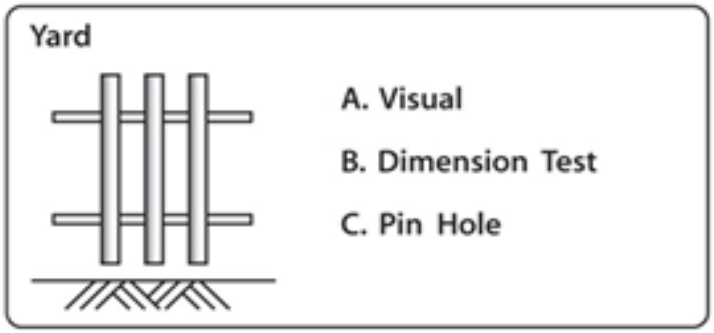
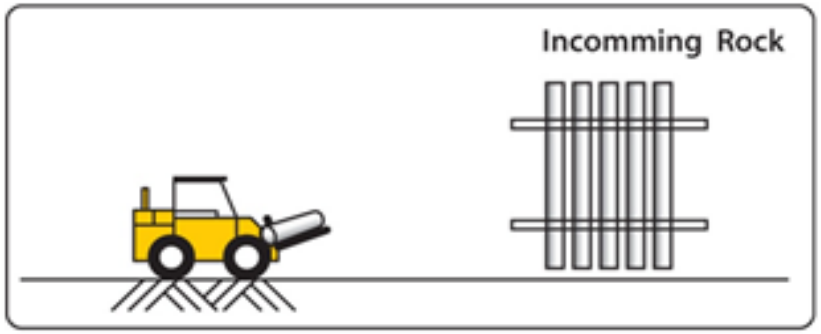
- Transportation & Shipment



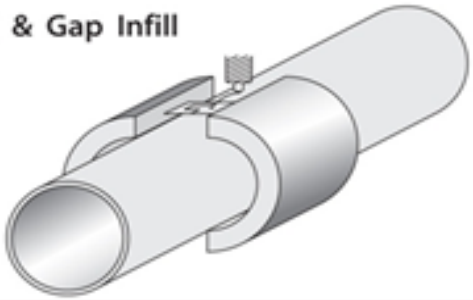


- Inland Transportation
- Incoming Inspection
- Anode Inspection & Installation
- Cage Installation
- Concrete Coating
- Weighing & Cleaning
- Transportation & Shipment

A. Visual

B. Dimension

Pin Brazing & Gap Infill



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- Incoming Inspection
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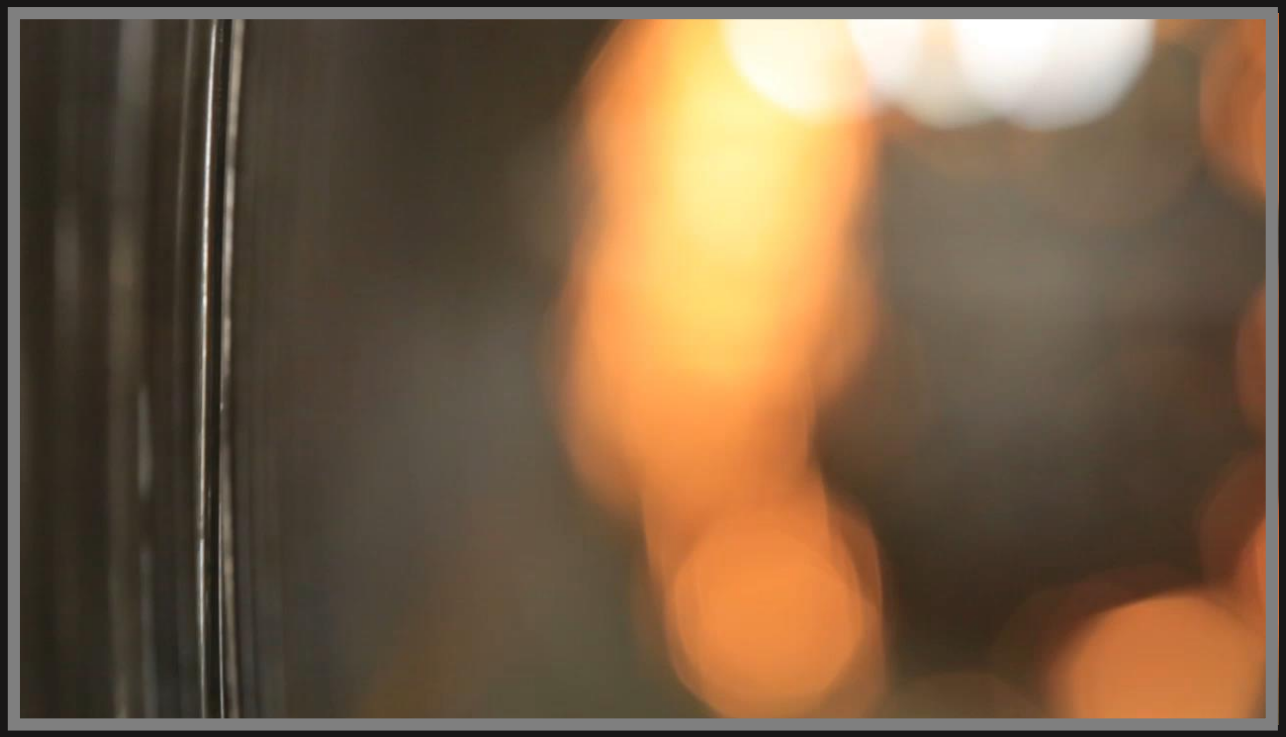

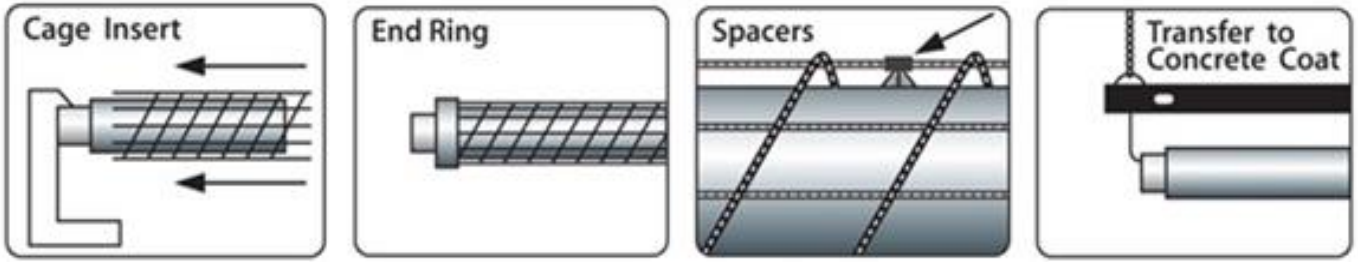

- Inland Transportation
- Incoming Inspection
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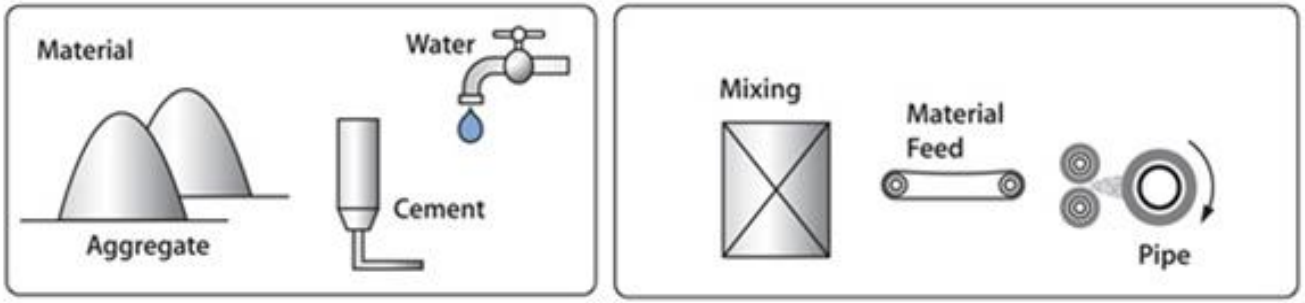
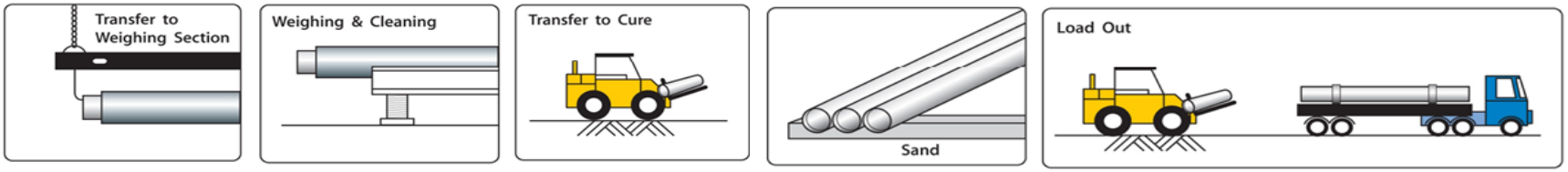
- Cage Installation
- Concrete Coating
- Weighing & Cleaning
- Transportation & Shipment



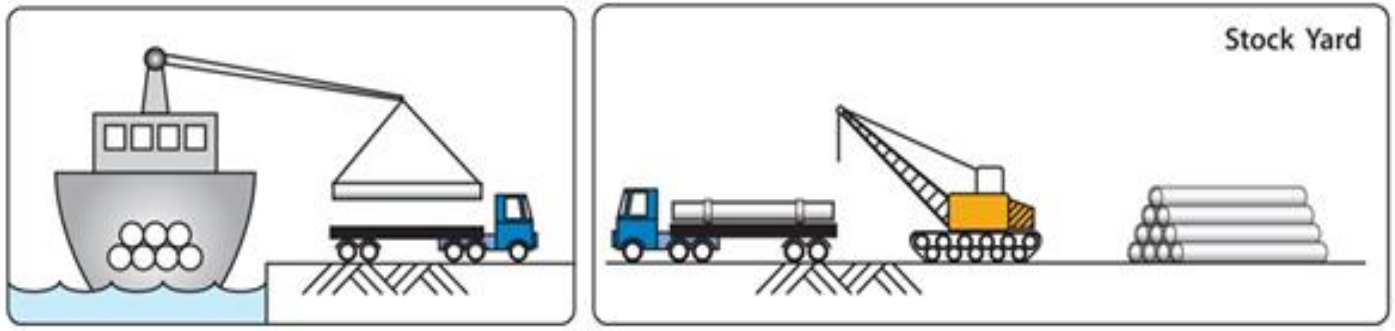
Manufacture Process (CWC)

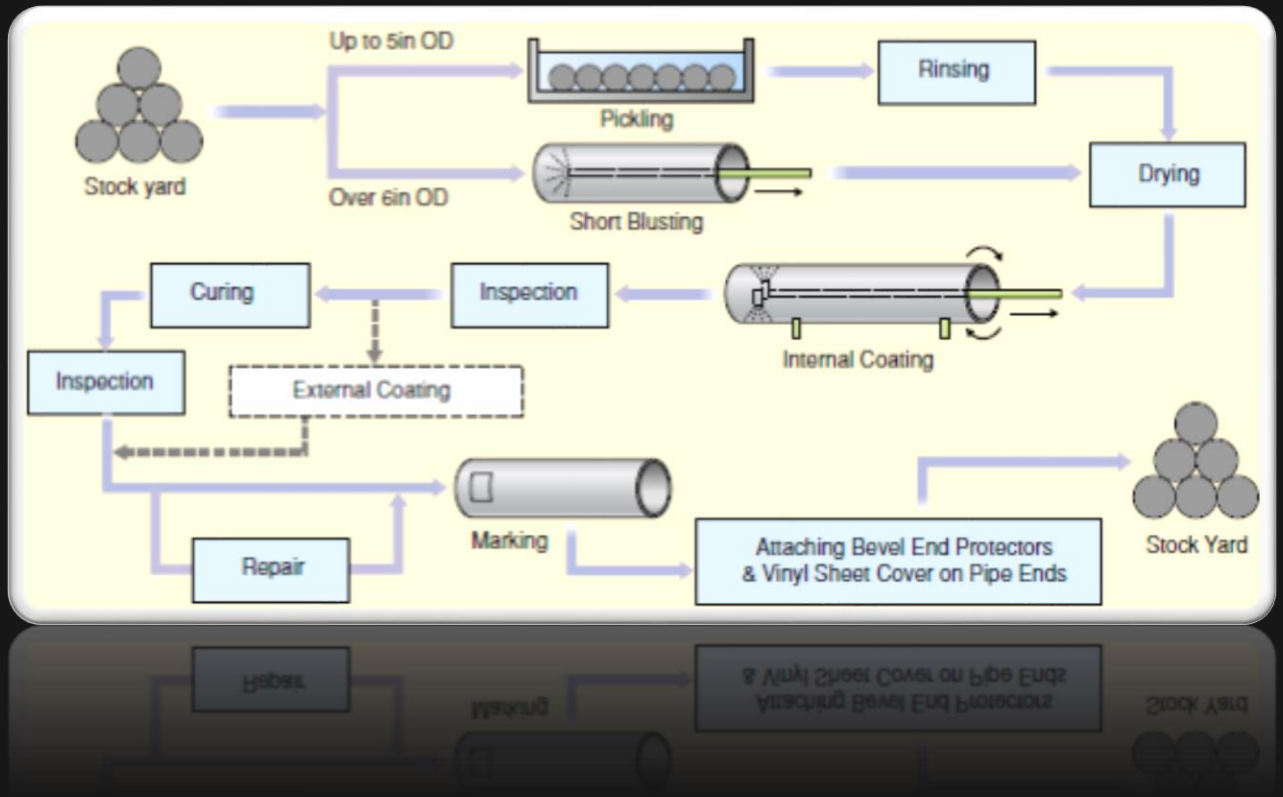
- Inland Transportation
- Incoming Inspection
- Anode Inspection & Installation
- Cage Installation
- Concrete Coating
- Weighing & Moving
- Transportation & Shipment

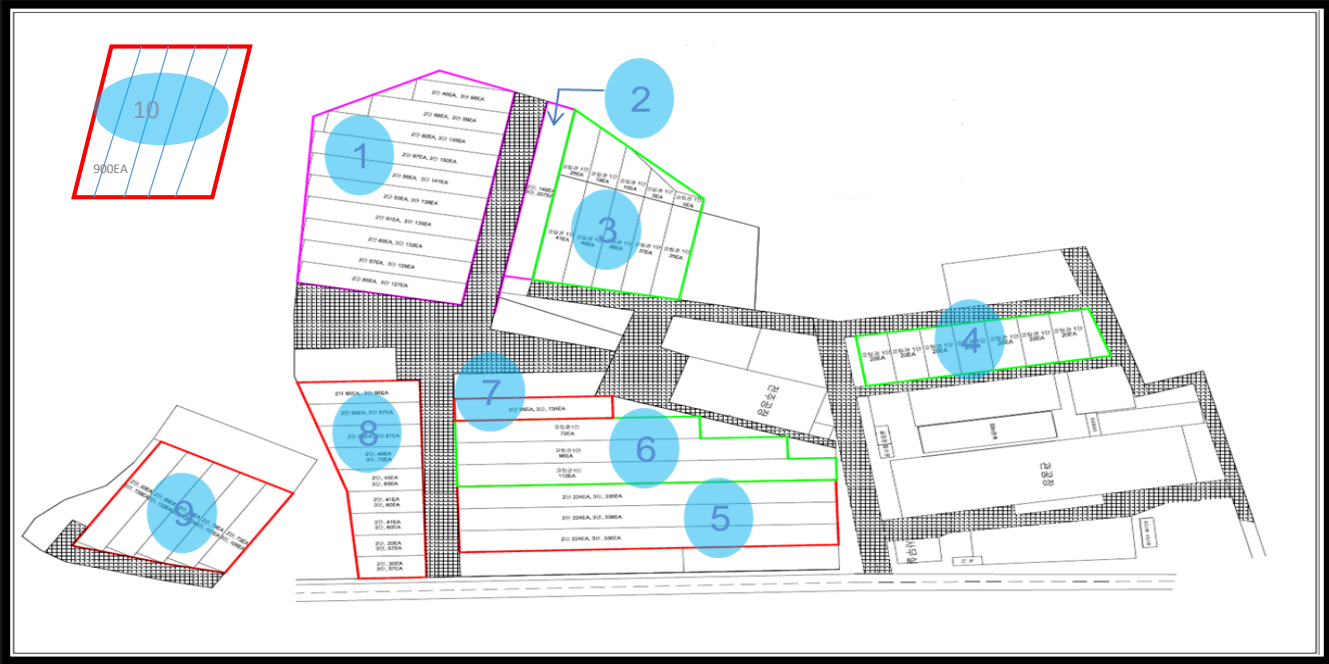


Manufacture Process (CWC)

- Inland Transportation
- Incoming Inspection
- Anode Inspection & Installation
- Cage Installation
- Concrete Coating
- Weighing & Cleaning
- Transportation & Shipment




Up to 5in OD
Pickling
Rinsing
Stock yard
Over 6in OD
Short Blasting
Drying
Curing
Inspection
Internal Coating
Inspection
External Coating
Marking
Repair
Attaching Bevel End Protectors
& Vinyl Sheet Cover on Pipe Ends
Stock Yard



Shop's Yard

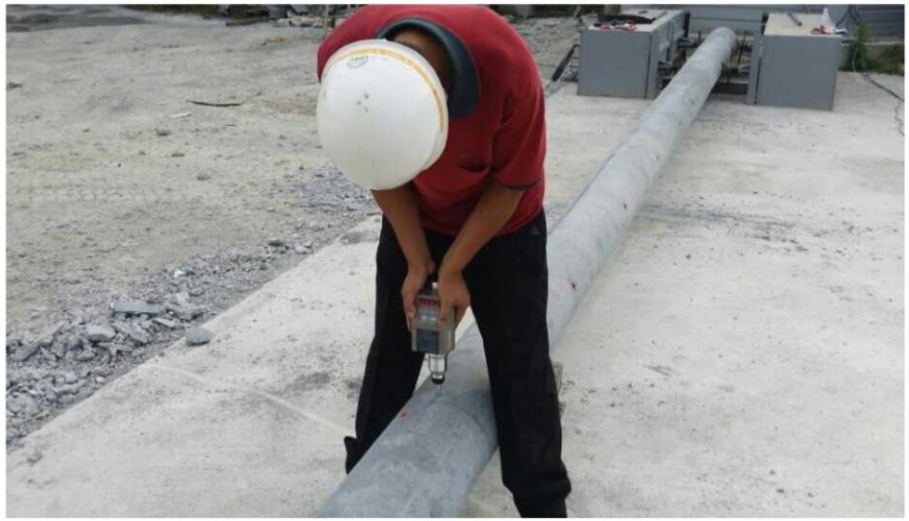
Yard NO.	Size (m²)	2 Layer (pcs)	3 Layer (pcs)
1	9,553	800	1,160
2	1,366	100	170
3	5,453	200	
4	3,019	110	
5	6,578	610	950
6	5,579	220	
7	924	90	130
8	4,580	320	590
9	4,333	400	740
10	8,170	550	930
Total	50,000	3,500	5,500

Port Lease

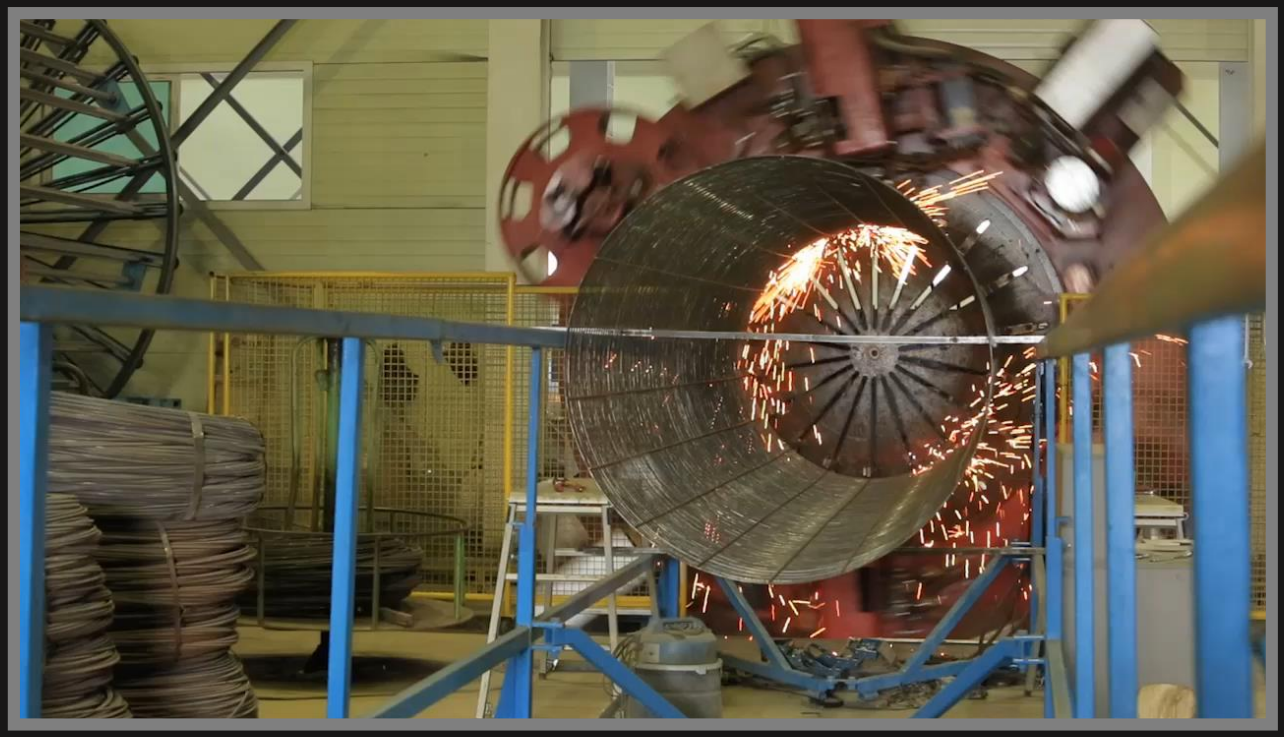
	Size(m²)	Min	Max	Operation	Layer
P.T Port	50,000	500pcs	5,000pcs	2times / y	2 ~ 3
I.C Port	25,000	250pcs	2,500pcs	1times / y	2 ~ 3

Buyang Industry has been intensively making an effort to create international standards through tests such as strength test, external pressure test, hydraulic test, mixing ratio, and absorption rate. The created standards will be used to develop the next generation of concrete products.

- Compressive Strength
- Concrete Mixture Test
- Outside Pressure
- Water Absorption Test
- Coefficient of roughness
- Bending Strength Test
- Dimension measurement
- Electrical load test
- Core specimen test
- Pinhole Test
- PT(Penetrate Test)
- Nondestructive test
- Welding Test
- Hydraulic Pressure Test
- Roundness Test



- Concrete Weight Coating
- Cement Lining
- PCCP
- Jacking Pipe
- Concrete Pole
- PC Pipe



Applications

Gas pipes, oil pipelines, water pipes, etc. / Protect underwater steel pipes

Advantages

Negative buoyancy, mechanical protection / Various customization options

Sizes

Diameter : up to 1,270mm

Applicable Specifications

ASTM, BSEN

- Concrete Weight Coating
- Cement Lining
- PCCP
- Jacking Pipe
- Concrete Pole
- PC Pipe

Cement Mortar coating is applied to a steel pipe's exterior for damage prevention, and cement lining is applied to a steel pipe's interior for corrosion prevention.

Buyang Industry offers coating and lining systems in various thicknesses for different types of steel pipes.

- Concrete Weight Coating
- Cement Lining
- PCCP
- Jacking Pipe
- Concrete Pole
- PC Pipe

Applications

drinking water pipes, cooling water pipes, fire water pipes, etc.

Advantages

Excellent anti-corrosion performance / Harmless to humans / Various customization options

Sizes

Diameter : up to 3,000mm

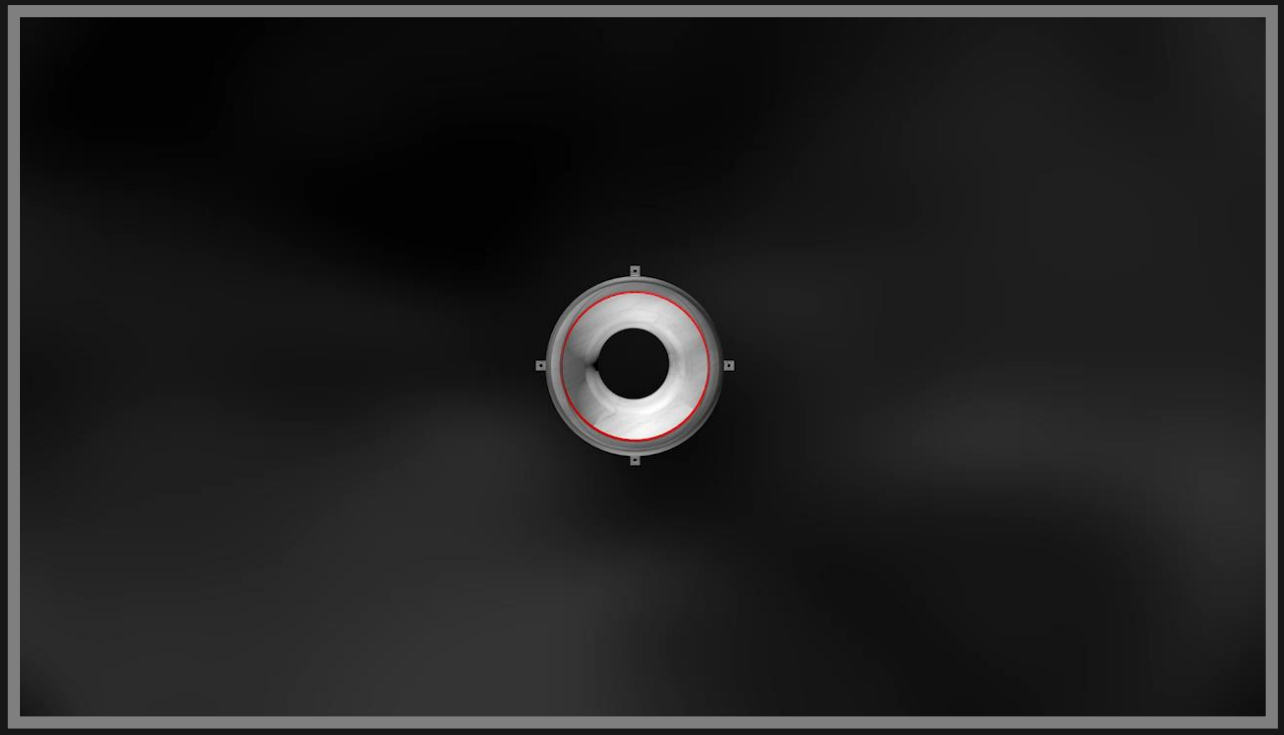
Joints

Flange method / Welding method : butt welding & sleeve welding

Applicable Specifications

AWWA C205 - Standard for Cement-Mortar Protective Lining and Coating for Steel Pipe

- Concrete Weight Coating
- Cement Lining
- PCCP
- Jacking Pipe
- Concrete Pole
- PC Pipe



PCCP is designed to utilize high tension strength of steel pipe and excellent compressive strength of concrete.

It is the best choice for pressure pipe.

Buyang Industry's PCCP has superior strength, anti-corrosion and durability.

- Concrete Weight Coating
- Cement Lining
- PCCP
- Jacking Pipe
- Concrete Pole
- PC Pipe

Applications

Water and wastewater pipe / Power-plant cooling water pipe / Industrial pressure pipe

Advantages

The Highest Strength and Water-tightness

High Security proven by Long-term Use

Sizes

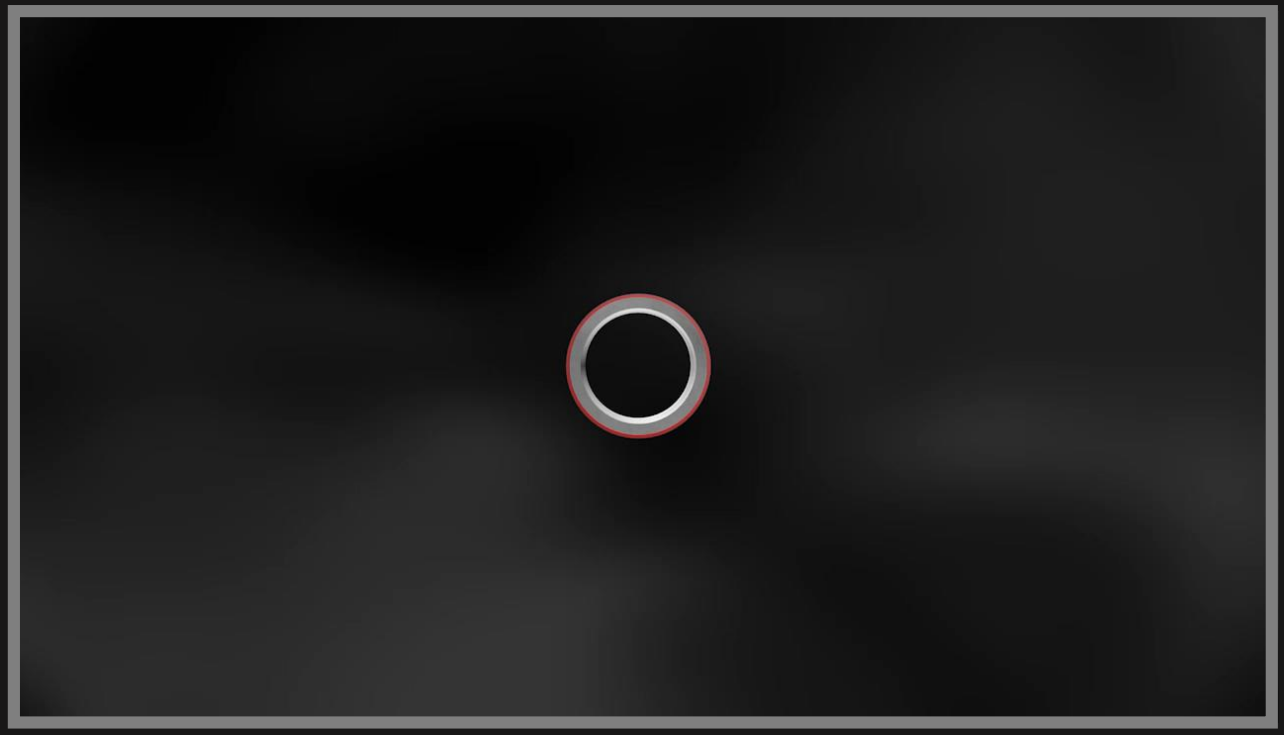
Diameter : from 500mm to 3000mm / Pressure : from 11 [kgf/cm2] to 25 [kgf/cm2]

Applicable Specifications

AWWA C301 - Standard for Prestressed Concrete Pressure Pipe, Steel Cylinder Type

AWWA C304 - Standard for Design of Prestressed Concrete Cylinder Pipe

- Concrete Weight Coating
- Cement Lining
- PCCP
- Jacking Pipe
- Concrete Pole
- PC Pipe



Jacking pipe is used for installing pipelines by tunneling method to avoid surface disruption commonly generated in open cut construction.

- Concrete Weight Coating
- Cement Lining
- PCCP
- Jacking Pipe
- Concrete Pole
- PC Pipe

Applications

Underground crossing pipeline for highways, railroads, airport runways, waterways
Underground pipeline in cities
Intersection of pipeline
To avoid surface disruption

Sizes

Diameter : from 500mm to 3000mm

- Concrete Weight Coating
- Cement Lining
- PCCP
- Jacking Pipe
- Concrete Pole
- PC Pipe

PC Pole is used for industrial and household power line, streetlight, outdoor multipurpose pole, and construction pile. It is the most widely used concrete product.

- Concrete Weight Coating
- Cement Lining
- PCCP
- Jacking Pipe
- **Concrete Pole**
- PC Pipe

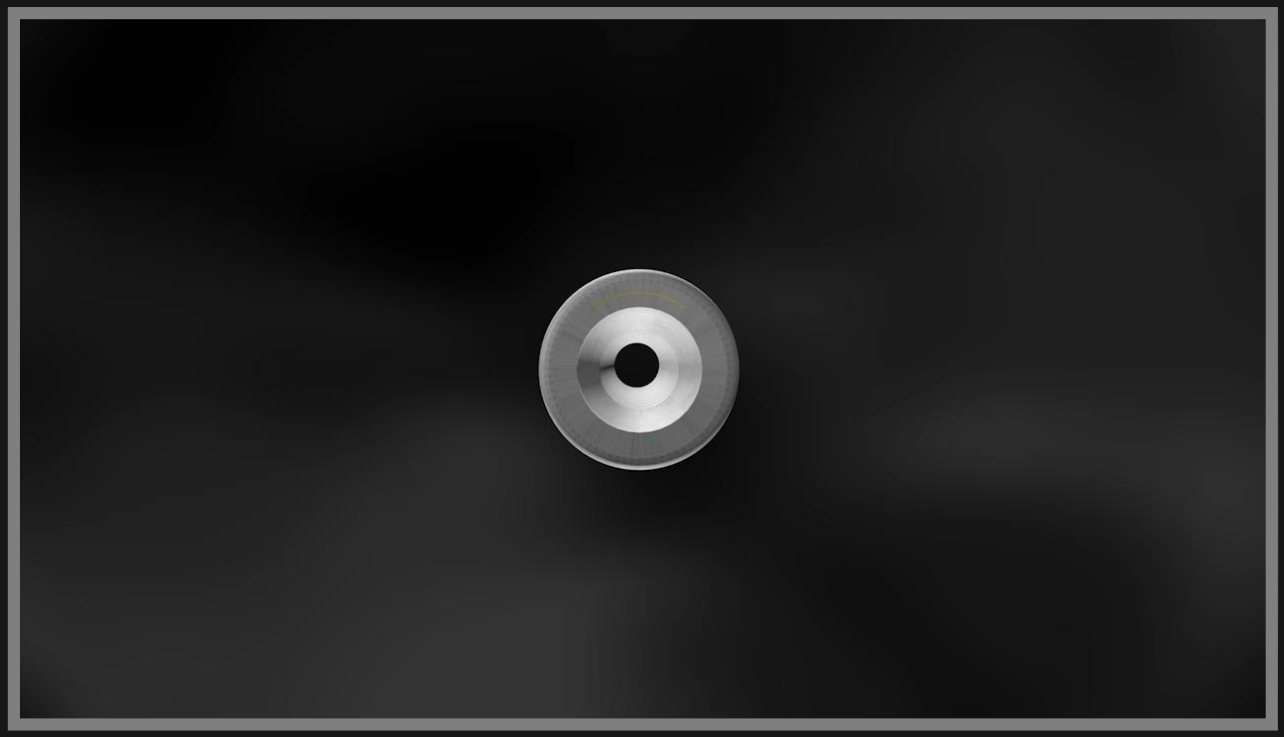
Applications

Industrial and household power pole / Downtown streetlight pole / Construction pole / Outdoor multipurpose concrete pole

Sizes

Diameter : from 100mm to 200mm
Length : 8m ~ 22m
Compression Strength : 500 kgf /cm^2- 1,200 kgf/cm^2

- Concrete Weight Coating
- Cement Lining
- PCCP
- Jacking Pipe
- Concrete Pole
- PC Pipe



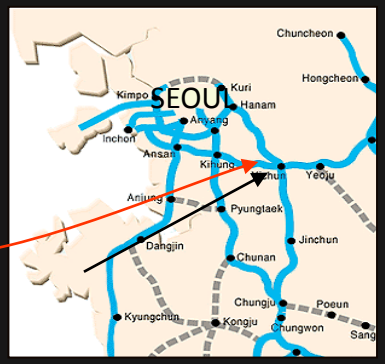
PC pipe is a representative pressure pipe. By winding pre-tensioned steel wire over a concrete core in cylindrical direction, PC pipes can resist higher internal/external pressures than reinforced concrete pipes. PC pipes are more economical than PCC pipes because the steel pipe is not used for core.

Application

Intake and drain pipe, Water and wastewater pipe, Industrial pressure pipe

Diameter: 500mm ~ 3,000mm
Hydro Pressure: 4kgf/cm2 ~ 18kgf/cm2

Major Contractors (Customers)



Our Incheon Factory is located at :

Icheon Office & Factory

#1144-4, Jukdang-ri, Bubal-eup, Icheon-city, Gyeonggi-do, Korea

Thank you

BUYANG INDUSTRY