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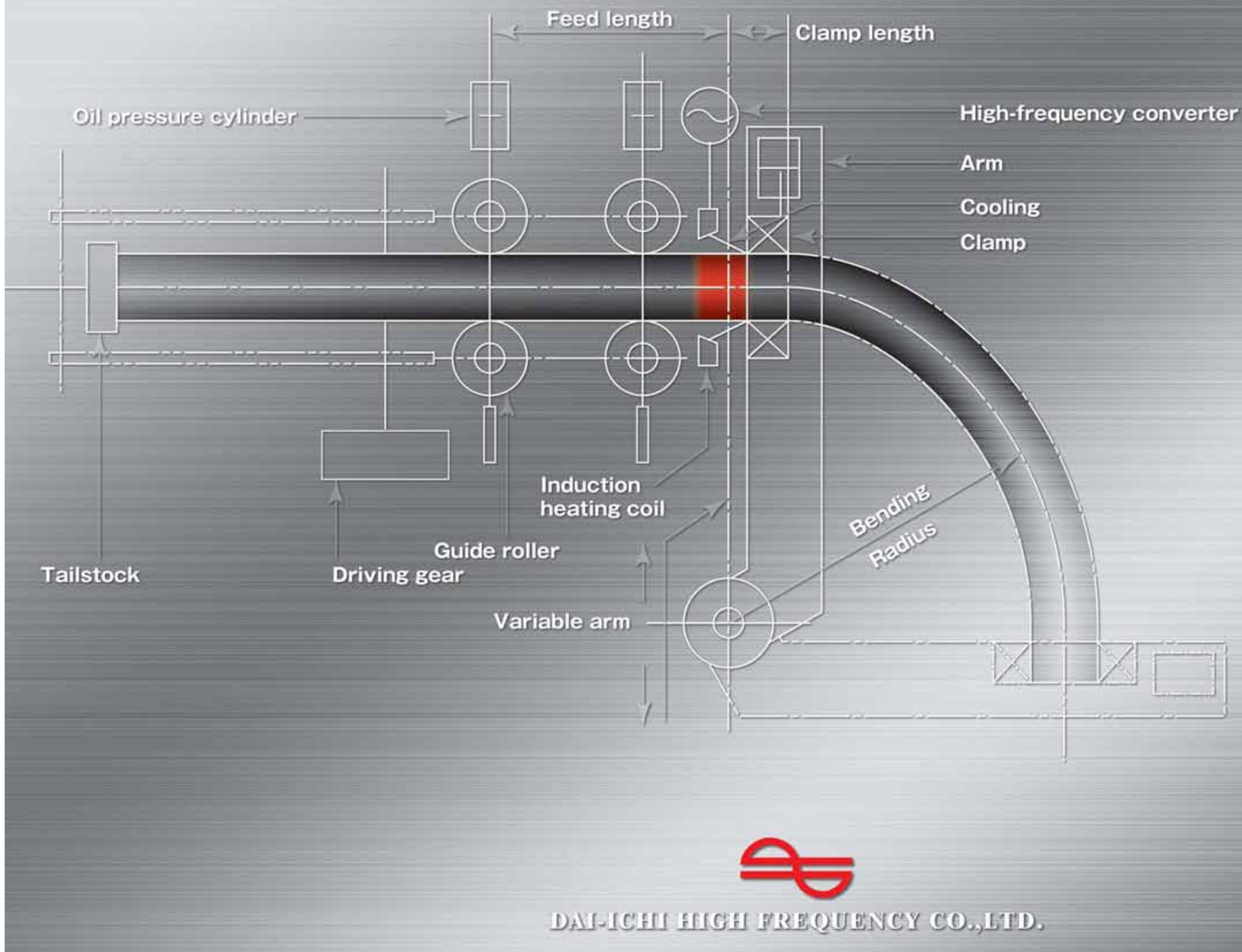
Induction Pipe Bends

DHF®



DAI-ICHI HIGH FREQUENCY CO.,LTD.

What are DHF Induction Bends?

Dai-ichi High Frequency Co., Ltd. (DHF) led the world when it developed its original technology for Induction pipe bending utilizing high-frequency induction heating in 1962. Successful research and development has further enhanced this technology, such as offering improvements in dimensions and shape, development of small-radius bending, and technological processing improvements in line with such upgrading. As a result, it has made a great contribution to society in a wide range of applications: piping for various plants including marine, power, petroleum, gas, chemical, and environment plants; line pipes for LNG, petroleum, gas, and steam; and in recent years, in steel materials used for building and civil construction.
DHF aims to offer the world's leading pipe-bending technology, products and solutions for your satisfaction.

Characteristics of Induction pipe bending

Induction bending enables precision control of the conditions for heating and cooling narrow sections of steel pipe to ensure more stable quality and shape. Accordingly, it has many advantages over cold bending or the use of elbows:

(1) Free-shape processing
No bending die is needed to process any bending radius or angle. S-bends, such as detoured conduits, and those with three-dimensional or multiple bends are also possible.

(2) Highly accurate processing
The use of hot bending ensures that any spring-back affecting the bend radius and angle can be minimized to assure stable dimensional accuracy.

(3) Small-radius bending of heavy-walled steel pipes
Heavy-walled pipes for high-pressure steam piping can be bent to a small radius by controlling the processing conditions, such as the heating temperature and cooling speed.

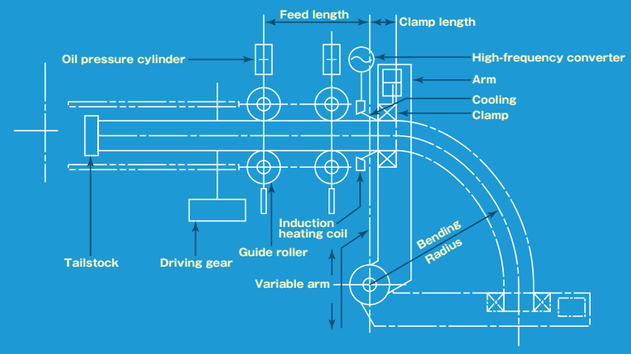
(4) Bending for even mechanical properties e.g. strength and toughness
High-grade bends are available by applying methods of processing in consideration of material characteristics and by meeting the mechanical requirements e.g. the values of strength and elongation.

Scope of high-frequency bending

Material : Carbon steel, Alloy steel, Stainless steel, Aluminum, Titanium, Hastelloy, Cupronickel, etc.
Standard : API , ASTM, JIS, ISO,BS etc.
Size : Pipe Outside-Diameter : Maximum. 48”
Shaped steel Size : Maximum 900mm-H
Wall-Thickness : Maximum 130mm
Bending Radius : 1.5DR, 2DR, 3DR ～ Max.400ft

Outline of Bending Method

The Pipe clamped on the arms is gradually local induction heated from O.D. pushing foward at a constant speed, so that bending stress is concentrated at the heated zone, and continuously deformed to product.



Bend for Pipeline

In recent years, demand for natural and synthetic gases as alternate energy to fossil fuels such as petroleum and coal has increased. This has necessitated trunk pipeline projects for their supply infrastructures in many countries. On the other hand, deterioration and damage to parts of the existing pipelines has accelerated due to environmental conditions such as climate change, earthquakes, and soil displacement, and their replacement is scheduled. As development of natural resource areas extends to extremely severe regions, such as the arctic and offshore conditions, so the requirements for line pipes has diversified while the operating pressure has increased with the requirement for high-strength line pipes. Bend pipes, a critical link for energy provision, as well as the special properties required for line pipe such as seamless, electric-resistance-weld, and UOE pipe, need higher strength, low-temperature toughness, on-site weldability, and corrosion resistance. DHF provides bent products realized through its years of experience and technology to meet requirements for stable dimensions and shapes and material characteristics.

Technology to manufacture bend pipes

Bend pipes for use in pipelines are manufactured in accordance with multiple specifications considering operational environments and conditions, as well as with due consideration for material design and manufacture through dimensions and shapes to non-destructive inspections (NDI). DHF defines processing conditions based on years of experience in production and accumulation of testing data to provide bent pipes with appropriate heat history, stable strength, and toughness.

(1) Technology to improve material strength characteristics

In bend pipes, specific processing with rapid heating and quenching is conducted to provide products with a stable material structure. DHF has established its tempering-less bending technology for steel pipes of up to API 5L X 65 grade intended for line pipes and its products are employed as bends for use in domestic gas trunk lines. The application of its technology has also realized alloy or stainless steel clad bends which have garnered a high reputation for expertise in its field.

(2) High-grade bend development

Higher-grade requirements for gas pipelines up to X 100 have accelerated for thin-walled but high-strength products and higher operational pressures. DHF has promoted research and development to meet these market needs, providing high-grade bends made of API high tensile steel, Duplex stainless steel and weldable 13Cr steel for more severe corrosive environments.

(3) Technology to improve the bending process

DHF's process technology enables bends to have material characteristics obtained by bending them under continuous heat treatment conditions without separating the tangent and bent sections in accordance with specifications.

DHF Induction Pipe Bend for pipeline

Material : API 5L Gr.B ～ X 80, Weldable 13Cr steel, Duplex, Stainless steel, Clad Pipe, etc.
Pipe Size : 1" ～48"
Bending Radius : 3DR, 5DR, 10DR、(Minimum:1.5DR Maximum.400ft-R)

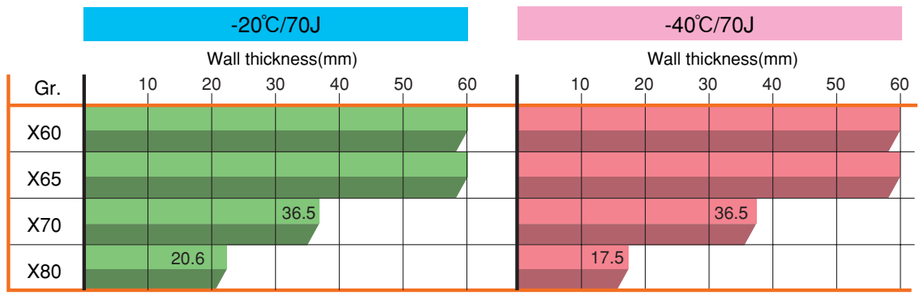


Fig. Applicable bending size for UOE pipe

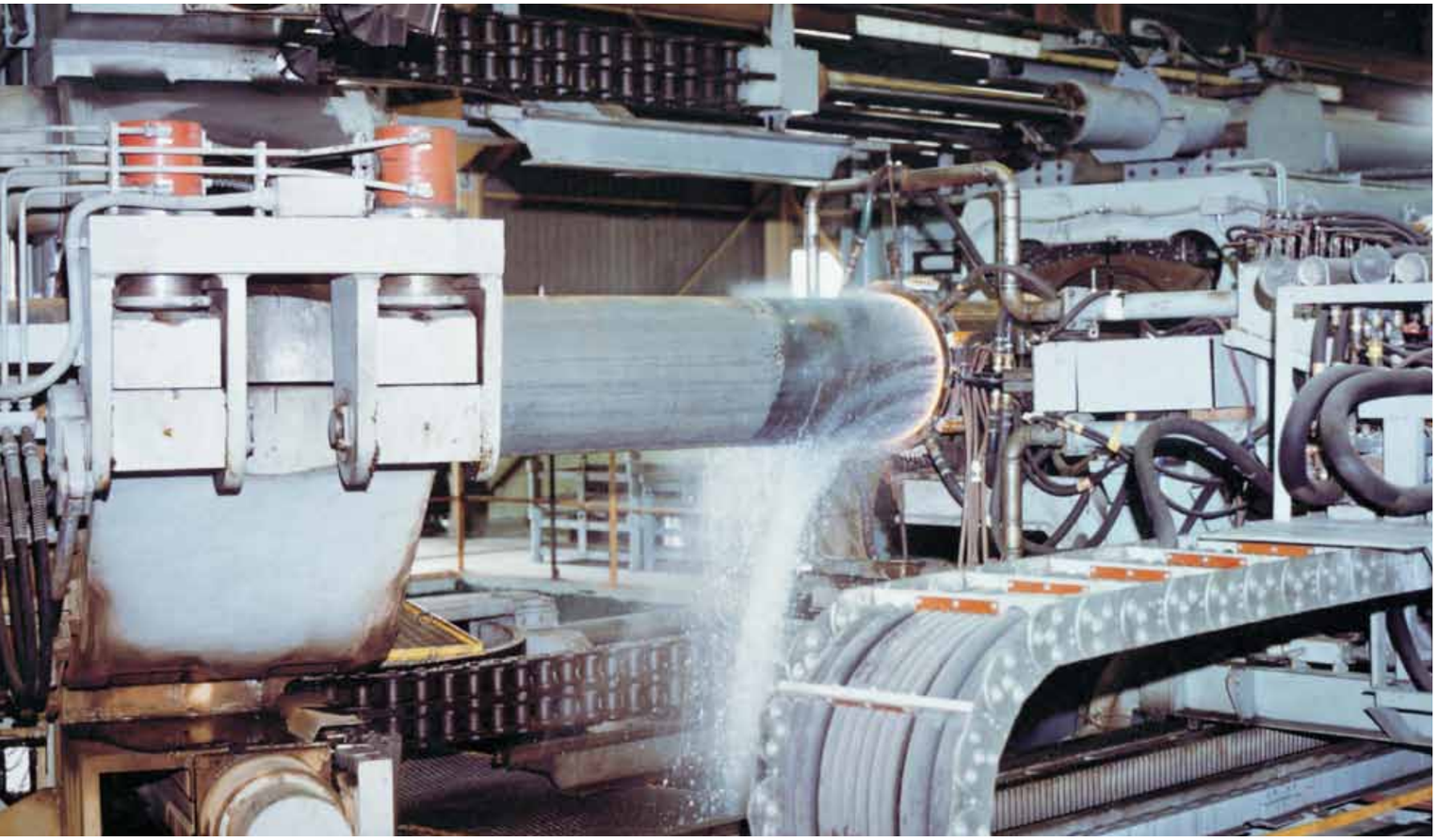
External anti-corrosion coated pipe suitable for underground piping

Various heavy-duty anti-corrosion coatings are used for underground pipelines depending on the environments and operational conditions under which they are laid. DHF's polyethylene coating technology is highly appreciated for its 40-year-service. DHF has also developed other anti-corrosion products by making the best of the induction heating technology to meet market needs, which have included high-frequency bends with their exteriors coated with materials other than polyethylene.
Coating material: Polyethylene, Fusion Bonded-Epoxy etc.

Polyethylene coating Bends for Gas line

DHF Bend & Polyethylene coating pipe for gas transmission line

Heavy-Pipe Bends for High pressure pipings



Induction bends have been adopted for the main steam pipes and various other pressure piping for nuclear and thermal power generation, petroleum and petrochemical plants. DHF has developed high-frequency bending machines for heavy-walled and small-radius bending, HPB model 30 and BB model 12, intended for use in nuclear power plants to reduce the weld lines. These machines are equipped with functions to prevent wall thickness reduction according to compression mechanism and control the wall taper at the bend interface and are dedicated to extra-heavy-walled pipe bend production. Conventional heavy-walled elbows are expensive and difficult to procure with short delivery times. By bending heavy-walled pipes using high-frequency with small radii equivalent to elbows, requirements for shorter delivery time and fewer welds have been met and, in addition, welding and NDI costs are typically reduced for more rationalized piping.

Heavy Pipe Bend

Material : ASTM A106, ASTM A335, A312, A333
ASME T23, P91, P92
Pipe Size : 1" ~ 30"
Wall-Thickness : Maximum 130mm
Bending Radius : 1.5DR ~ 3DR ~ 10DR

Heat history in Induction pipe bending is similar to that for heat treatment of steel. Carbon steel and low alloyed steel are induction-heated to the normalization temperature and stainless steel to the solution heat treatment temperature, bent within the hot plasticity area, and then immediately quenched. In principle, the cooling method is selected in accordance with the material quality and required quality. However, water-cooled bending is adopted for radii of 2 DR or smaller in order to retain the bent shape and post heat-treatment is applied necessary.

When bending a steel pipe to a small radius, wall thickness of extrados decreases while intrados increases. Using DHF's high-frequency bending, special "technology to inhibit reduction of wall thickness using compression stress control" and "technology to control tapering in increased wall thickness areas at the start and end of the bend" have been established. These technologies, as adopted for high-pressure piping, enjoy a high reputation.

(1) Application of the optimum bending and heat treatment conditions according to material
(2) Technology to inhibit wall thickness reduction using compressive force
(3) Smooth control of increase or decrease in wall thickness at the start and end of the bend
(4) Flattening control technology

1.5DR BENDS for Thermal power plant
ASTM A106 18"× 82mmT×685.8mmR

1.5DR BENDS for Nuclear power plant
ASTM A312 TP316L 24"× 38.6mm× 914.4mmR

Welding service for Power plant piping

Induction Pipe Bend for Plant & Shipbuilding

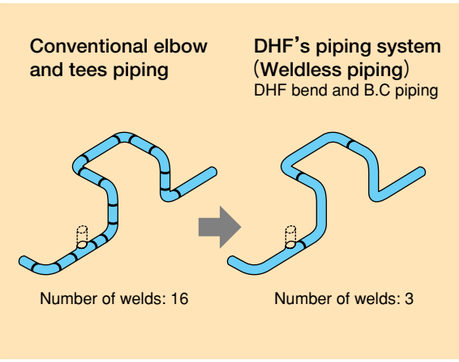
Induction bend pipes can meet various material requirements and adopt any bending radius and angle as well as multiple bends as required for use in applications for various and diverse industries and piping systems.

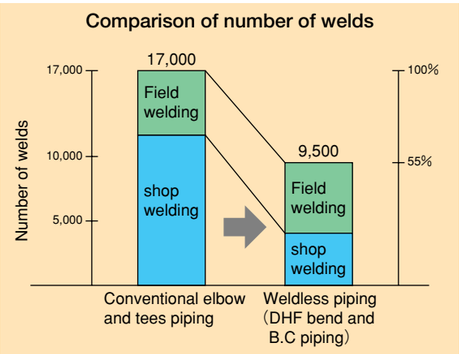
Bending radius	Industry	Examples	Applicable material
1.5DR～3DR	Petroleum refinery, petrochemical Environmental equipment, area-wide air conditioning Foods, medicines Store Shipbuilding, Floating Production Storage Offloading (FPSO)	Miscellaneous Fertilizer Refuse disposal, sludge disposal LNG, LPG Marine piping * * * * Cargo oil pipe	Carbon Steel/Stainless steel/Low Alloy Carbon Steel/Low Alloy Carbon Steel/Stainless steel/Low Alloy Stainless Steel Stainless Steel/Aluminum Killed Steel Carbon Steel 1% Cr
3DR～5DR	Petrochemical	Terephthalic acid plant	Titanium
5DR～15DR	Petrochemical	Pellet transport, powder transport	Stainless Steel
Special shape	Petroleum refinery Gas treatment	CCR heating furnace tube Reformer Ethylene/naphtha reaction tube	Inconnel, 9 Cr Incolloy, stainless steel Centrifuge-cast pipe Interior-finned tube
Special applications	Petrochemical	Heat-insulation pipe	Duplex tubes with stainless and carbon steels

Weldless piping system

for reducing manpower and construction term, as well as improving quality

The use of bends in place of elbows saves on labor in plant piping construction and cuts the number of welds needed. DHF provides petrochemical, power plants, and various other areas with its "weldless piping system". By reducing the number of welds, it is able to bring about many advantages, such as reduced welding and inspection costs, hydrostatic test, and construction term. Piping defects are mostly found with welds, and reducing the number of welds improves piping quality, therefore, our weldless piping system is highly evaluated as a way to cut labor costs on piping construction.





Rental Machine for site bending (Weldless piping system at site)

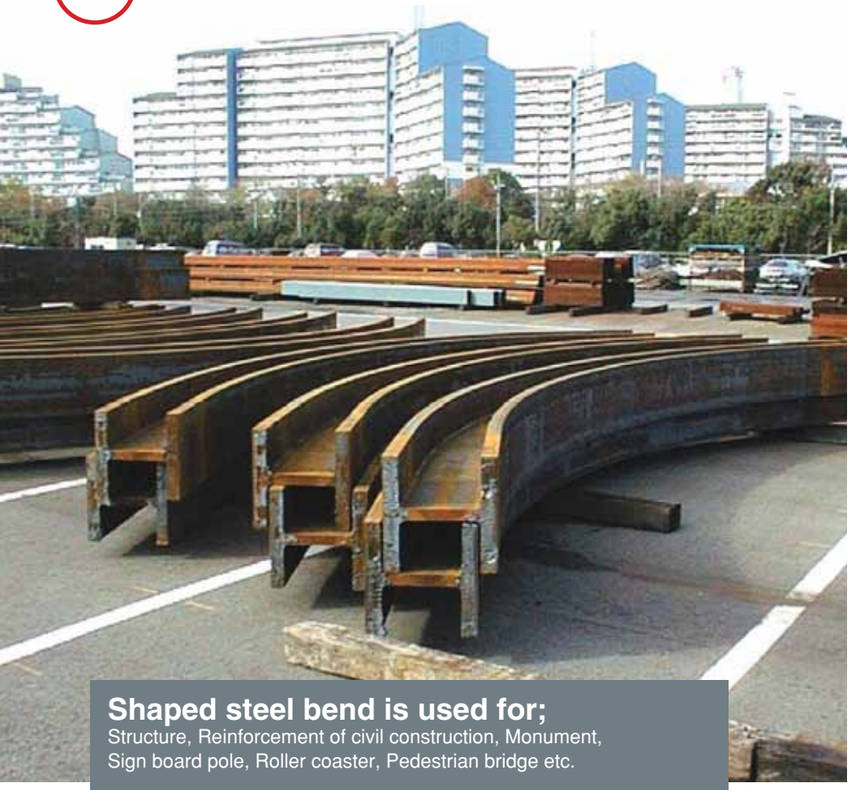
Site Bending Service by Rental Bender

* Mobile induction bending machine is available as rental bender service.
* Rental bending machine is dispatched and installed at plant site during construction.
* DHF's technical advice based upon experienced and accumulated knowhow can offer you a remarkable cost reduction.
* Weldless Piping System by using DHF's site bending service can be widely used in industrial plants.

Site Bending Service

Material : Carbon Steel, Stainless Steel, Low Alloyed steel. etc.
Outside Diameter : 2"～16" Bending Radius: 1.5DR,A2DR, 3DR
Supply Record of Rental Bender : Bangladesh, Indonesia, Japan, Malaysia, Qatar, Singapore, Taiwan, Thailand, Venezuela

Shaped Steel Bend

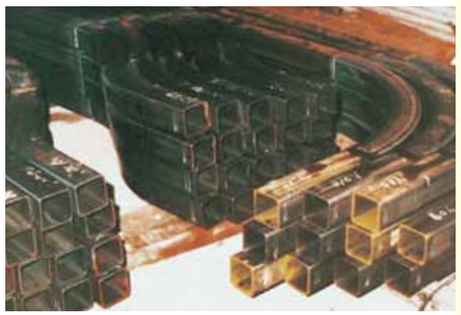


Shaped steel bend is used for;
Structure, Reinforcement of civil construction, Monument,
Sign board pole, Roller coaster, Pedestrian bridge etc.

● **Bending Application**
Material : Carbon Steel, Stainless Steel, Aluminum etc.
Shape : H Beam, Angle, Channel, Square Pipe, Rectangular Pipe, Bar
Example :
H beam size : Max.900H
Bending Radius: H100×100 6/8mm 250mmR
H600×200 11/17mm 3500mmR

H Beam 498×432m 45/70mm-thickness

Square Pipe 200×200m 9.0mm-thickness



Bending for Structure

Bending for Structures

Advances in CAD now allow for the use of many curves in structures. Consequently, DHF's bends support the free design and creation of a wide range of beautiful structures: aqueducts, pedestrian bridges, bridge footing arches, roof beams for stadiums, stations, pavilions, amusement facilities such as jet coasters, elevated railway pillars, supports for automotive noise insulation boards, monuments, and many others.

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