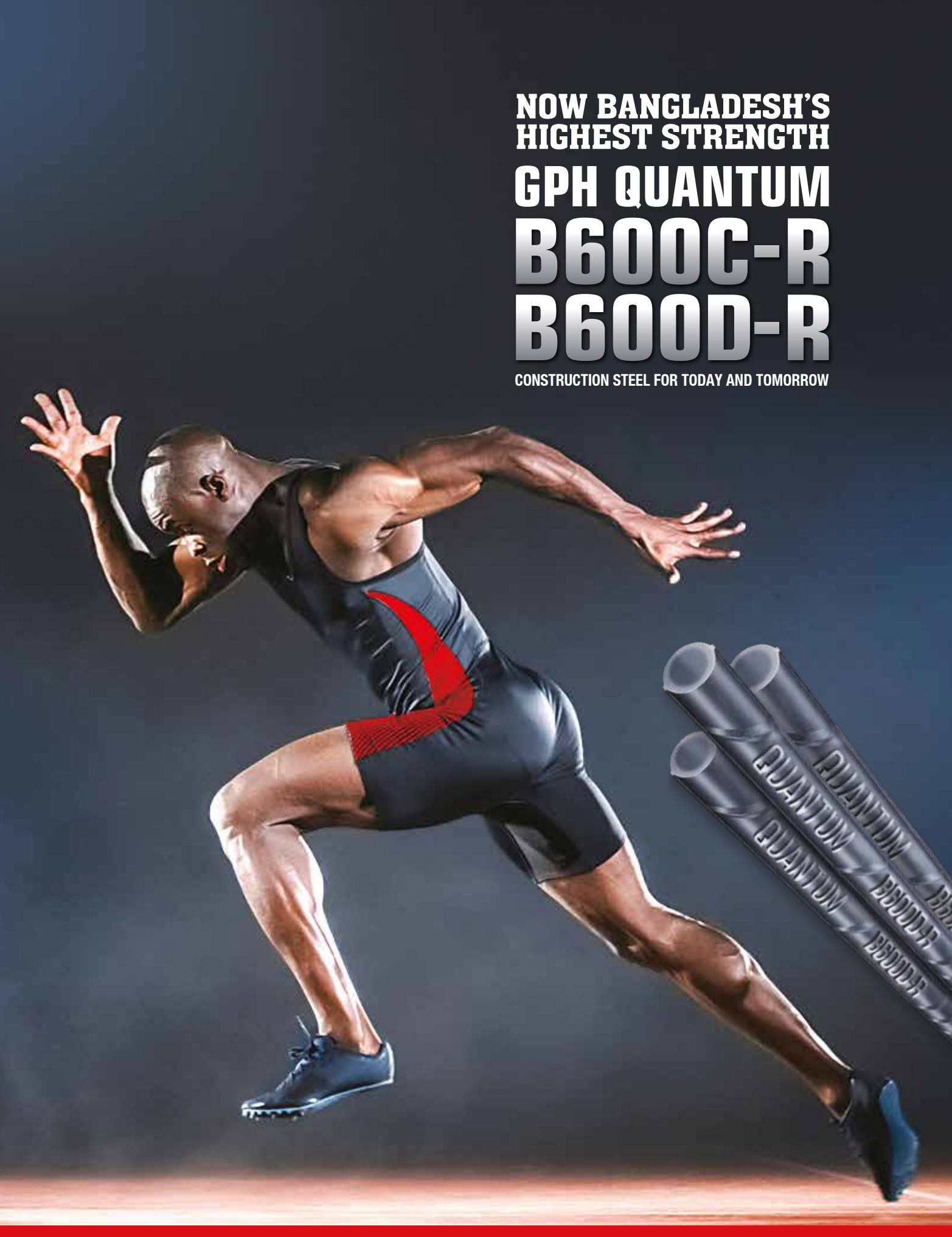

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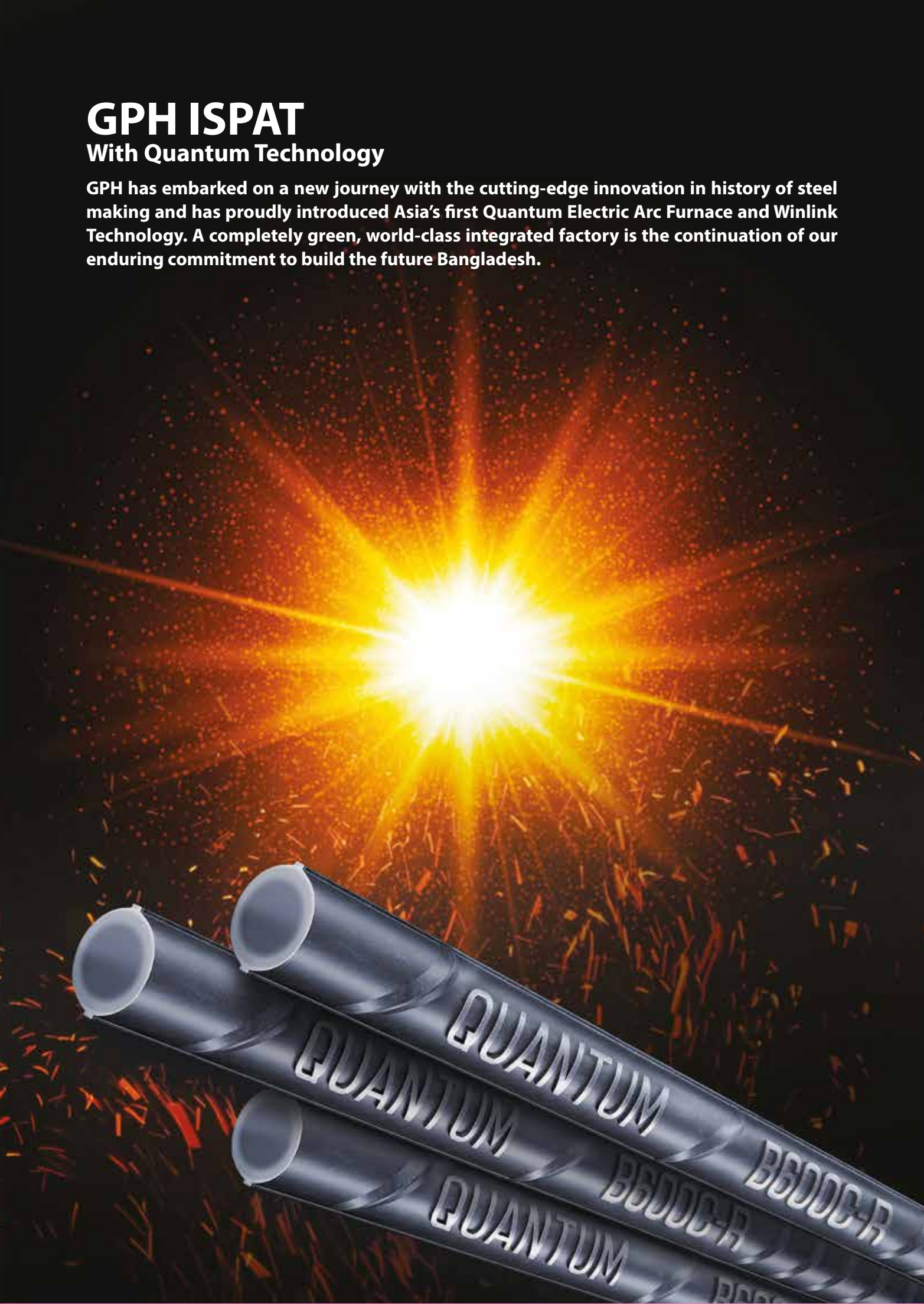
GPH ispat

GPH ISPAT

With Quantum Technology

GPH has embarked on a new journey with the cutting-edge innovation in history of steel making and has proudly introduced Asia's first Quantum Electric Arc Furnace and Winlink Technology. A completely green, world-class integrated factory is the continuation of our enduring commitment to build the future Bangladesh.



The World's Most Pure and Clean

GPH QUANTUM

Construction Steel

The story of GPH ispat is not an ordinary one. It all began with a vision. A vision for development.

With beliefs in sustainable development, GPH ispat is continuously working for development and for the people's welfare of the country. GPH Ispat has established Asia's first Quantum Electric Arc Furnace Technology driven integrated factory to enrich the steel sector in Bangladesh. GPH ispat is one of the leading steel manufacturing companies in Bangladesh that ensures the best quality of steel complying with the national and international standards.

GPH ispat has introduced, for the first time in Bangladesh, the level 2.5 automation in steel manufacturing industry and Enterprise Resource Planning enriched state-of-the-art technology with fully computerized integrated digital industry known as Industry 4.0. This makes it possible to produce the highest quality products using comparatively less energy. The main purpose of all our efforts is to bring you the world-class construction Re-bars through advanced technology.

We have a big dream, a dream of building a new Bangladesh, and you are the companions of this dream.

Vision

The trusted brand of Bangladesh leading the steel sector with innovative products leveraging cutting edge technology.

Mission

To provide the foundation for building the infrastructure of Bangladesh towards High-Income-Country (HIC) with the true GPH philosophy.

GPH agile

OUR VALUES

Appreciate what is given to us by Almighty
Grow through learning best practices home and beyond
Innovation is key to our product and service delivery
Leverage the power of teamwork
Empower people to deliver excellence

GPH QUANTUM Green Factory

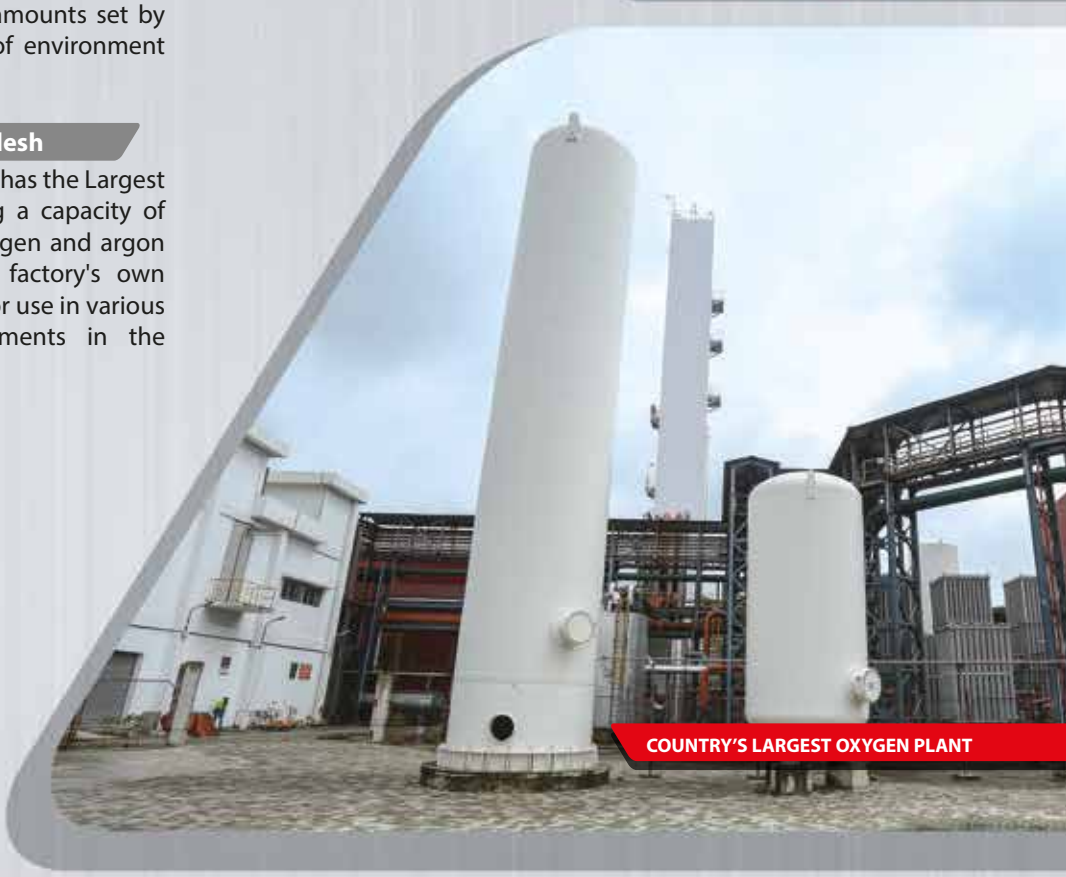
GPH ispat established Asia's first Quantum EAF Technology driven integrated factory in Bangladesh to avoid any harm to the environment with the following features.

1. Exhaust Gas Purification Unit

GPH QUANTUM Green integrated Factory has highly sophisticated and advanced exhaust gas purification system to keep the environment clean and safe. The amounts of carbon and dust emissions from the GPH QUANTUM factory is less than the amounts set by both world bank and department of environment Bangladesh.

2. Largest Oxygen Plant of Bangladesh

GPH ispat's Green integrated Factory has the Largest Oxygen Plant in Bangladesh having a capacity of 300MT/day. The liquid oxygen, nitrogen and argon produced in this plant meet the factory's own demand and the rest are marketed for use in various hospitals and industrial establishments in the country.



COUNTRY'S LARGEST OXYGEN PLANT

EXHAUST GAS PURIFICATION UNIT

3. Water Treatment Plant with Zero Discharge Technology

Only GPH ispat factory in Bangladesh has its own water harvesting system and water treatment plant with Zero Discharge Technology, so no water is wasted, except negligible vapour loss.

4. Own Substation

The factory has a 230/33 KV GIS substation for uninterrupted power supply.The amount of electricity saved in this green factory can be utilized in 1 lakh 92 thousand households per year.

5. Natural Gas Savings

The amount of natural gas saved in the GPH QUANTUM factory can meet the gas demands of 35,000 households per year.

WATER TREATMENT PLANT

230/33 KV GIS SUBSTATION

Why GPH QUANTUM Technology is the Best in making Construction Steel?

1. Completely Pure Steel

The Quality of GPH QUANTUM Re-bar is highly reliable because it contains -

- **Scrap Processing: In scrap yard, different types of scrap are processed through scrap shearing machine. Metals separated, then from metallic scrap only ferrous materials are segregated and resized for futher operation.**
- **Scrap pre-heating process: The GPH QUANTUM pre-heating chamber of the arc furnace heats the scrap above temperature 600^{0}C. During this process, it removes the paint, rust, moisture and primary impurities present in the scrap.**
- **Oxygen lancing and argon bottom purging: GPH QUANTUM removes unnecessary carbon and phosphorus by oxygen lancing and bottom purging in the arc furnace, turning the heated mixture into a homogenized mixture.**
- **Flat bath operation and bottom tapping: Pure flat bath operation is done by maintaining 70 MT hot heel in GPH QUANTUM arc furnace having holding capacity of 150 MT, where the chemical reaction of carbon and oxygen creates foamy slag, and removes phosphorus and other impurities. 80 MT of almost 100% slag free metal is collected into the ladle by tilting the furnace at a 4-degree angle through FAST (Furnace Advanced Slag-free Tapping) in a siphonic process.**

The GPH QUANTUM Re-bar is much more fatigue resistant than any other Re-bars in the market for its state-of-the-art refining and quenching system. So, the engineers can rely on GPH-QUANTUM Re-bar for any mega structure and to design any kind of earthquake resistant structure.

PREHEATING CHAMBER

OXYGEN LANCING

FLAT BATH OPERATION &
FAST BOTTOM TAPPING

2. Homogenized Chemical Mixture

Homogenized chemical composition in liquid steel ensured by Argon or Nitrogen bottom purging and harmful Phosphorus and other impurities are removed from the liquid metal by Oxygen lancing in Quantum Electric Arc Furnace. Chemical composition in GPH Re-bar is ensured by mixing the required ferro-alloys in LRF through automatic alloy addition. Moreover, Closed casting in CCM prevents entrapment of Oxygen and Nitrogen from air and EMS system ensures proper mixing of liquid metal and also helps to float the slag/impurities on top of the mold tube. The homogenized chemical properties are achieved in the Re-bar resulting in uniformity of strength along the Re-bar and the construction become stronger and safer.

CLOSED CASTING

LADLE REFINING FURNACE

3. Steel with High Ductility and Firm Bonding Strength

- Billets made in CCM are directly rolled in the most advanced and latest high-speed rolling mill with Winlink technology. The GPH QUANTUM Re-bar is more ductile than any other rebar in the market because of Quantum and Winlink technology.
- The new generation housing-less free-floating rolling stands and Tungsten Carbide Rolls ensure uniform diameter of the Re-bar, the relative rib area and proper transverse rib height makes the construction more secure by establishing a strong bond between the concrete and the Re-bar.

CONTINUOUS CASTING MACHINE

HOUSING-LESS FREE FLOATING ROLLING STAND

4. Uniform Strength and Corrosion Resistant

- Fully automatic computerized Quenching Method ensures a uniform Martensite Ring in the Re-bar; that is why there is no strength variations from start to end.
- State-of-the-art refining and quenching system ensure the uniform tempered and residual stress-free martensite ring which provides assurance for uniform strength and enhance corrosion resistance properties.

TMT QUENCHING BOX

HIGH SPEED TWIN CHANNEL

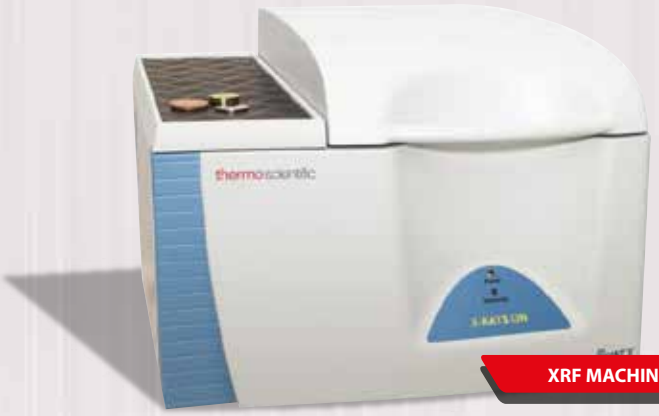
TUNGSTEN CARBIDE ROLL

5. Shiny Surface

- The use of more tungsten carbide rolls in the rolling process makes the surface of the GPH QUANTUM Re-bar shinier.

6. Quality Consistency

- For quality control, we have 2000 KN Automatic Universal Testing Machine, Universal Hardness Testing Machine, Profilometer, Bend & Re-bend Testing Machine, X-ray Fluorescence Spectrometer (XRF), Microscope, Impact Testing Machine, Bond Testing, Ring Testing, Macro Etching and Wet Chemical Lab. Moreover, we have advanced M12 Spectrometer from Germany. At each stage of production, the state-of-the-art GPH lab is rigorously controlled by these testing machines to maintain the quality of the Re-bar. We have portable spectrometer for identification and segregation of harmful scrap from the good scrap in the main scrap yard. In our laboratory, testing equipment are integrated to the level-2 system which sends the test results instantly to the process control engineers which ensures fast and precise steel making.



XRF MACHINE

BEND & REBEND TESTING MACHINE

M12 SPECTROMETER

PROFILOMETER

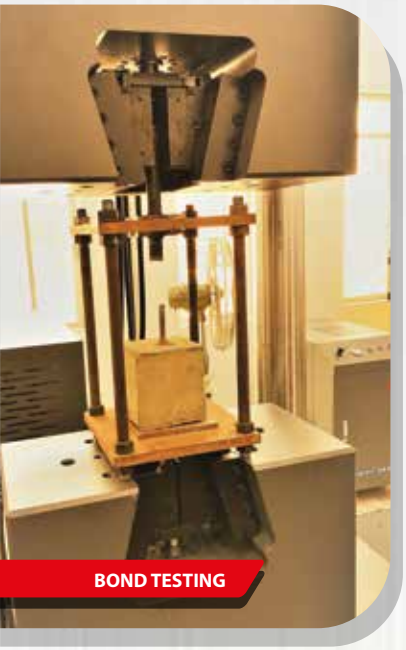
Every stage of GPH QUANTUM Re-bar production such as scrap processing and charging, melting, refining, casting, rolling and TMT processes are integrated and uninterrupted.

The use of world-class technology ensures perfect homogenized chemical properties, uniform strength, superior ductility and bendability.

That is why GPH QUANTUM Re-bar guarantees safe and strong structures.

RING TESTING

RING TESTING MICROSCOPE



BOND TESTING

UNIVERSAL HARDNESS TESTING MACHINE

MICROSCOPE

AUTOMATIC FINE POLISHING MACHINE

CHARPY IMPACT TESTING MACHINE

MACRO ETCHING SETUP

UNIVERSAL TESTING MACHINE

BUILT TO BUILD WORLD'S STRONGEST STRUCTURES GPH QUANTUM B600C-R AND B600D-R CONSTRUCTION STEEL

Introduction

There is a growing interest within the concrete industry in using high strength reinforcing steel for various constructions. This interest is driven primarily by relief of congestion; particularly in high-rise buildings assigned for a high seismic design category (moment frame buildings). There are also other areas where high strength bars can help facilitating construction efficiencies or combined with high-strength concrete—allow reinforced concrete to be used in more demanding applications. The adoption of ASTM A 1035 in 2004 created the material specification that allows for 100 ksi and even 120 ksi reinforcing steel but it remains to be determined how the design codes will address it. Today, the vast majority of concrete design and construction uses Grade 60 steel, with occasional but increasing use of Grade 72.5 (Grade 500). The long-term question for the industry is whether the introduction of 100 ksi or higher strength reinforcing steel is merely a new niche product to help congestion relief in constructions or if the emergence of these materials is the beginning of a movement to higher strength reinforcing steel.

The main demand for high strength reinforcing steel has been referred to construction where congestion issues, especially at beam-column intersections continue to plague Re-bar placing and design. Typical spacing of the confinement steel in the columns is 100 mm to 125 mm using standard Grade 420 (10 mm and 12 mm). At times this creates severe congestion issues at the intersection areas. The ability to use high strength bars in these congested areas could really improve placement problems and fabrication time. Over the total cost of the project, this could add up to significant savings offsetting any additional costs of the higher strength material.

In Bangladesh the concrete construction has experienced the use of improved materials such as high strength concrete and high strength reinforcing steel in recent years. A new development that promises to increase the economy of conventionally reinforced concrete is the application of high strength reinforcement, that is, bars having a yield strength over 500 MPa. Such high strength reinforcing bars would lead up to smaller concrete sections and/or lower costs. These advantages would be especially beneficial in high-rise buildings for mat foundations, footings, pile caps, shear walls and columns; and also for bridge constructions. Many countries of the world like India, Indonesia, some European and American countries started using the high strength Re-bar form long back and taking the advantages of high strength Re-bar.

Earlier, as per BDS ISO 6935-2: 2006, RB 500W is the highest steel grade for Re-bar. After revision in 2016, in BDS ISO 6935-2:2016, B600C-R included as the highest steel grade due to the structural requirements (Clause No 7, 8.1 & 9.3 Table-4,5,6 & 8). B600D-R is recently added steel grade in ISO 6935-2:2021, which is already approved.

Recently with the accessibility of B600C-R and B600D-R grade reinforcement steel in business sectors, experts are thinking about the utilization of B600C-R and B600D-R grade and taking its front line preferences.

Highest Ductility
Maximum Strength
up to 30% savings

Applications

B600C-R and B600D-R are one of the strongest steel grades that construction firms can get while growing rock-solid framework ventures, spans, marine offices and so on. B600C-R and B600D-R offers more noteworthy rigidity, decreases general utilization and guarantees lesser steel clog inside the support. Typically used in construction of high rise structures, structures subjected to high service loads, heavy duty infrastructure projects and in cases where the maximum area of reinforcement steel is to be reduced.

Advantages of B600C-R/B600D-R

Steel Savings: B600C-R and B600D-R have the highest yield strength among the available Re-bars, so it will take much lesser space in RCC. If we use B600C-R & B600D-R it will reduce the steel usage compared to B500CWR/B500DWR or B420DWR, it will take 17% and 30% less steel respectively. It will consume more percentage of steel in the section if lower grades like B500CWR/B500DWR is used. So, it will be economical to use B600C-R & B600D-R in the construction by proper designing.

Manpower for Steel fixing/Installation: Less workers are required to install /fixing steel reinforcement onsite.

Reduction in Congestion/Constructability: Higher Strength requires lesser number of bars to carry similar loads resulting in lesser congestion, hence improving the quality of construction by imparting ample space for pouring concrete and compaction.

Logistics: Less trucks to deliver the product to site – frees up site space and saves crane, manpower and time.

Site Crane: Handles less steel and frees up crane time for other construction activities thereby speeding up construction.

Concrete Savings: Reduction in structural element size is possible when used with appropriate grade of concrete and results in overall load being reduced.

More Usable Space: More floor space is usable with column size reduction.

Less Formwork: Possible to reduce formwork needed for columns and beams due to member size reduction.

Lighter Foundations: Due to reduction in members size resulting in lighter super structures, foundation loads and costs can be reduced.

Improved Safety: Site safety will be improved due to less material handling, steel fixing etc.

Time Reduction: Overall time savings can be accomplished by factoring in the earlier stated benefits.

Cost Reduction: Overall cost reduction can be achieved from reduced material, manpower, construction time etc.

Reduced Environment Effect: Reduced construction noise, fuel consumption etc.

Typical Calculations of Economic Benefits of Using B600C-R/B600D-R Grade in Column

Design Load (KN)	Column Dimension (mm)	Gross Area of Column (mm^2)	Compressive Strength of Concrete (MPa)	Steel Grade	Yield Strength of Steel (MPa)	Required Steel Area, (mm^2)	Maximum Savings of Steel Consumpntion**
4000	500x500	250000	17.2	B420DWR	420	9959.316	30.7% savings compared to grade B420DWR & 17.1% savings compared to grade B500CWR
				B500CWR	500	8317.829	
				B600C-R/D-R	**600**	**6896.901**	
			24.1	B420DWR	420	6435.447	31.1% savings compared to grade B420DWR & 17.3% savings compared to grade B500CWR
				B500CWR	500	5361.788	
				B600C-R/D-R	**600**	**4436.568**	
			29.3	B420DWR	420	3710.646	31.3% savings compared to grade B420DWR & 17.4% savings compared to grade B500CWR
				B500CWR	500	3085.820	
				B600C-R/D-R	**600**	**2549.244**	

**Actual amount of savings varies from case to case according to the actual design.

Typical Calculations of Ecomomic Benefits of Using B600C-R/B600D-R Grade in Beam

Design Moment (KN-m)	Beam Dimension (mm)	Effective Depth (mm)	Compressive Strength of Concrete (MPa)	Steel Grade	Yield Strength of Steel (MPa)	Required Steel Area (mm^2)	Maximum Savings of Steel Consumption**
150	375x300	335	17.2	B420DWR	420	1510.76	30.0% savings compared to grade B420DWR & 16.7% savings compared to grade B500CWR
				B500CWR	500	1269.04	
				B600C-R/D-R	**600**	**1057.53**	
			24.1	B420DWR	420	1378.34	30.0% savings compared to grade B420DWR & 16.7% savings compared to grade B500CWR
				B500CWR	500	1157.81	
				B600C-R/D-R	**600**	**964.84**	
			29.3	B420DWR	420	1333.82	30.0% savings compared to grade B420DWR & 16.7% savings compared to grade B500CWR
				B500CWR	500	1120.41	
				B600C-R/D-R	**600**	**933.67**	

**Actual amount of savings varies from case to case according to the actual design.

Technical Specifications of B600C-R

Nominal Weight, Dimension and Dimensional Tolerance of GPH B600C-R as per BDS ISO 6935-2:2021:

Nominal Diameter	Nominal Weight	Permissible Tolerance	Cross-sectional Area	Length (per ton)		Ton and Piece Count (1 pc=12 meter approx.)
mm	Kg/m	%	mm2	m	ft.	no. of bar
16	1.58	±5	201	633.58	2078.67	53 (1 ton)
20	2.47	±5	314	405.59	1330.35	34 (1 ton)
25	3.85	±4	491	259.51	851.42	22 (1 ton)
28	4.84	±4	616	206.88	678.75	18 (1 ton 45 kg)
32	6.31	±4	804	158.39	519.67	14 (1 ton 60 kg)
40	9.86	±4	1257	101.37	332.59	9 (1 ton 65 kg)

Technical Specifications of B600D-R

Nominal Weight, Dimension and Dimensional Tolerance of GPH B600D-R as per BDS ISO 6935-2:2021:

Nominal Diameter	Nominal Weight	Permissible Tolerance	Cross-sectional Area	Length (per ton)		Ton and Piece Count (1 pc=12 meter approx.)
mm	Kg/m	%	mm2	m	ft.	no. of bar
16	1.58	±5	201	633.58	2078.67	53 (1 ton)
20	2.47	±5	314	405.59	1330.35	34 (1 ton)
25	3.85	±4	491	259.51	851.42	22 (1 ton)

Requirements for Ribs

Ribbed bars shall have transverse ribs. Longitudinal ribs will be present. There shall be at least two rows of transverse ribs equally distributed around the perimeter of the bar. The transverse ribs within each row shall be distributed uniformly over the entire length of the bar except in the area of marking.

Mechanical Properties of Grade B600C-R as per BDS ISO 6935-2:2021

Steel Grade	Ductility Class	International Standard	Yield Strength	Tensile Strength	Elongation at Max Force (Agt)	TS/YS	Elongation after Fracture	Bend Test	Re-Bend Test	Rib Geometry		
					Gauge Length= 200mm		Gauge Length=5D (mm)	Mandrel Diameter (mm)	Mandrel Diameter (mm)	Transverse Rib Height (mm)	Longitudinal Rib Height (mm)	Rib Spacing (mm)
B600C-R	C	BDS ISO 6935-2:2021	87000 Psi (600 MPa) (Min)	1.15* Y.S (Min)	7 % (Min)	1.15 (min.)	10 % (Min)	≤16mm: 3D 16mm<D≤ 32mm: 6D 32mm<D≤ 50mm: 7D	Not Recommended	0.03D (min.)	0.15D (max.)	D<10: 0. 5D-1.0D D≥10: 0.5 D-0.8D

Mechanical Properties of Grade B600D-R as per BDS ISO 6935-2:2021

Steel Grade	Ductility Class	International Standard	Yield Strength	Tensile Strength	Elongation at Max Force (Agt)	TS/YS	Elongation after Fracture	Bend Test	Re-Bend Test	Rib Geometry		
					Gauge Length= 200mm		Gauge Length=5D (mm)	Mandrel Diameter (mm)	Mandrel Diameter (mm)	Transverse Rib Height (mm)	Longitudinal Rib Height (mm)	Rib Spacing (mm)
B600D-R	D	BDS ISO 6935-2:2021	87000 Psi (600 MPa) (Min)	1.25* Y.S (Min)	8 % (Min)	1.25 (min.)	10 % (Min)	≤16mm: 3D 16mm<D≤ 32mm: 6D 32mm<D≤ 50mm: 7D	Not Recommended	0.03D (min.)	0.15D (max.)	D<10: 0. 5D-1.0D D≥10: 0.5 D-0.8D

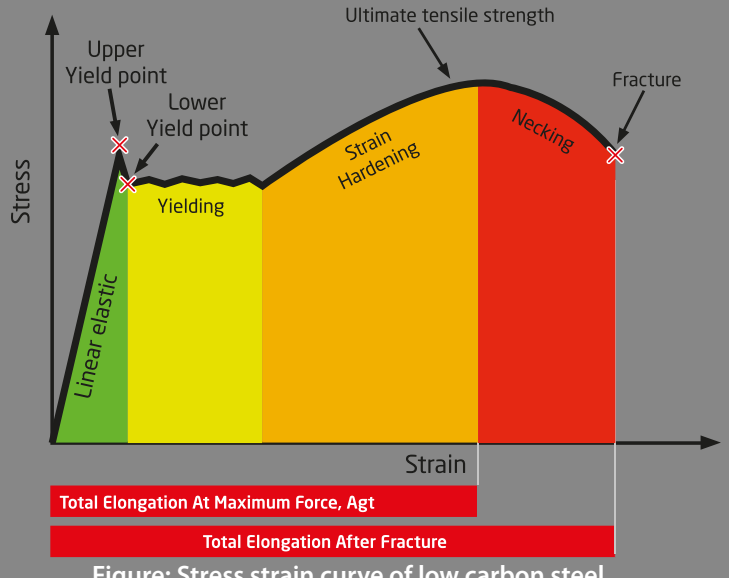


Figure: Stress strain curve of low carbon steel

Mechanical Properties of B600C-R, B600D-R & Equivalent Grades Specified by Different Manufacturing Standards

Standard	Grade	Ductility Class	Yield Strength (Mpa)		Ultimate Strength (Mpa)	TS/YS	%Elongation at Max. Force	%Elongation after Fracture	Bend Test
			min.	max.	min.	min.	min.	min.	Mandrel Dia. (mm)
BDS ISO 6935-2:2021	B600C-R	C	600	-	-	1.15	7	10	≤16:3D 16<D≤32:6D 32<D≤50:7D
	B600D-R	D	600	720	-	1.25	8	10	
IS 1786:2008+A3:2017 (India)	Fe 600	-	600	-	660	1.06	-	10	≤20:5D >20:6D
JIS G 3112:2020 (Japan)	SD590A	-	590	679	695	1.18	-	10	2D
	SD590B	-	590	650	738	1.25	-	10	
GB/T 1499.2-2018 (China)	HRB600		600		730		7.5	14	6 ~ 25:6D 28 ~ 40:7D > 40 ~ 50:8D
KS D 3504 (Korea)	SD600	-	600	-	710	-	-	10	≤25:2.5D >25:3D
ASTM A706/A706M-22	Grade 80 (550 to 675)		550	675	690	1.25		D≤36:12 D>36:10	10 ~ 16:3.5D 19 ~ 25:5D 29 ~ 36:7D 43 ~ 57:9D

Chemical Composition of B600C-R, B600D-R & Equivalent Grades Specified by Different Manufacturing Standards

Elements (max.)	BDS ISO 6935-2:2021		IS 1786:2017 (India)	JIS G 3112:2020 (Japan)		GB 1499-2:2018 (China)	KS D 3504 (Korea)	ASTM A706/A706M-22
	B600C-R	B600D-R	Fe 600	SD590A	SD590B	HRB600	SD600	Grade 80 (550 to 675)
%C	-	0.37	0.30	0.45	0.45	0.28	-	0.30
%Si	-	0.55	-	1.00	1.00	0.80	-	0.50
%Mn	-	1.80	-	2.00	2.00	1.60	-	1.50
%P	0.060	0.040	0.040	0.040	0.040	0.045	0.050	0.035
%S	0.060	0.040	0.040	0.040	0.040	0.045	0.050	0.045
%N	-	-	0.012	-	-	0.012	-	-
%CEV	-	0.67	-	0.80	0.80	0.58	0.63	0.55

Conclusion and recommendations of research results on application of B600C-R rebar to columns and beams

Introduction

The purpose of this study is to assess the performance of different structural members reinforced with different grades of rebar. Total twenty-seven specimens were tested. Nine beams were tested under two-point flexure test; nine columns were tested under compressive load and cyclic loading was applied for test on nine beam-column joint specimens. In addition to the experiments, design comparisons were made for beams, columns and two-way slabs designed with different grades of steel. A 10-storied reinforced concrete intermediate moment frame residential building was designed using different grades of steel. The reinforcement requirement at the ground floor and mat foundation of the building was compared. The findings of this research are presented in this chapter.

Conclusions from the Experiments

Major findings of the experiment are presented below:

i. Moment capacity of beam increased 10.9% to 15.5% when reinforced with B600C-R in place of B420DWR and 2.5% to 4.7% when compared to B500CWR. For each class of concrete moment capacity of B600C-R was higher than B420DWR and B500CWR.

ii. Load capacity of column, although being a compression member, increased about 7.3% to 18.1% when reinforced with B600C-R instead of B420DWR and about 2.1% to 9.6% when B600C-R is provided in lieu of B500CWR.

iii. Grade of steel can also influence the lateral load carrying capacity of joints. Higher grade steel can sustain more number of cycles in push-pull cyclic test. Lateral load capacity also increased approximately 16.4% to 32.8% for B600C-R when compared to B420DWR and up to 14.2% when compared to B500CWR.

Conclusions from the Design Comparisons

Major findings from the design comparisons are presented below:

i. In case of beam design, B600C-R reduces steel consumption up to 30% when compared to B420DWR and up to 16% when compared to B500CWR.

ii. For columns designed with B600C-R, about 30% steel consumption is reduced when compared to B420DWR and about 16% is reduced when compared to B500CWR.

iii. For slabs 31% reduction in steel is found when B600 C-R is compared to B420 DWR. This percentage reduces to 16% when B600 C-R is compared to B500CWR.

Conclusions from the Design of the 10-Storied Building

Major findings from the design comparisons are presented below:

i. 25% saving is achieved in the design of mat foundation of the 10-storied building when B600C-R is used instead of B420DWR and 9.4% saving is possible compared to B500CWR.

ii. For ground floor beams, B600C-R can save 29.9% and 16.9% steel as compared to B420DWR and B500CWR respectively.

iii. Design of ground floor columns can be economized by 14.3% and 3.1%, respectively for B600C-R in comparison to B420DWR and B500CWR.

General Comments

Finally, in general, following comments can be made about using B600C-R.

i. Use of B600C-R can substantially save steel consumption and reduce the cost of construction.

ii. For similar loading condition, B600C-R offers congestion free sections contributing to better concreting.

iii. Since lower diameter bars are required for B600C-R, less amount of development length and splice length are required.

iv. Reduced requirement of steel implies reduced fabrication time and cost resulting in faster construction.

v. Transport cost can also be curtailed due to less requirement of steel.

vi. Energy demand for production steel will also decrease. Less amount of steel also implies less amount of exhaust gas and dust emissions during manufacturing process. All these factors will have positive impact on the environment and ensure sustainability.

Recommendations for Future Studies

A preliminary investigation of using higher grade steel in structural members has been performed in this study. Specimens have been prepared by using different grades of steel (B420 DWR, B500CWR, B600C-R) with different concrete classes to compare the results. Some areas where this research can be extended are presented below:

i. Specimen reinforced with B600C-R can be cast with more high strength concrete. Higher strength concrete can be prepared by using admixture.

ii. To get more information about stress strain pattern, strain gauges can be used.

iii. Dynamic actuators and LVDTs can be used instead of manually operated push-pull jack and deflection dial gauges.

iv. Finite element analysis can be adopted

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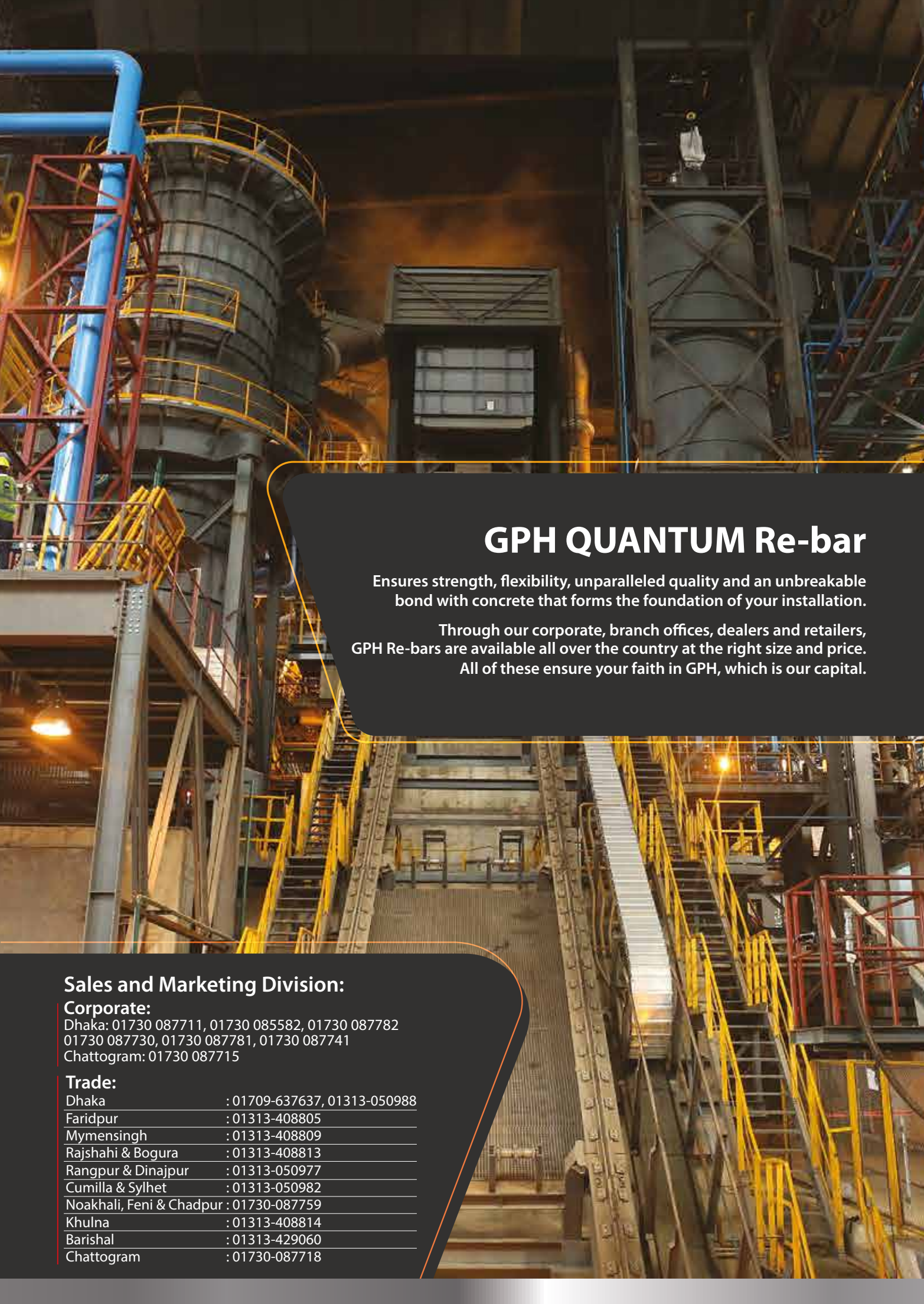
The Bangladesh We Want to Build

GPH's journey is based on its determination to build Bangladesh on a strong and solid foundation. Our country will be witnessing world-class factories, huge buildings, international standard roads, highways, flyovers, bridges, tunnels and many other facilities. An outstanding development in construction will be made in this country, which will attract tourists from home and abroad. A stadium will be built where the Olympic and World Cup will be held. We want to build this better Bangladesh with you.



GPH QUANTUM Re-bar

Ensures strength, flexibility, unparalleled quality and an unbreakable bond with concrete that forms the foundation of your installation.

Through our corporate, branch offices, dealers and retailers, GPH Re-bars are available all over the country at the right size and price. All of these ensure your faith in GPH, which is our capital.

Sales and Marketing Division:

Corporate:

Dhaka: 01730 087711, 01730 085582, 01730 087782
01730 087730, 01730 087781, 01730 087741
Chattogram: 01730 087715

Trade:

Dhaka	: 01709-637637, 01313-050988
Faridpur	: 01313-408805
Mymensingh	: 01313-408809
Rajshahi & Bogura	: 01313-408813
Rangpur & Dinajpur	: 01313-050977
Cumilla & Sylhet	: 01313-050982
Noakhali, Feni & Chadpur	: 01730-087759
Khulna	: 01313-408814
Barishal	: 01313-429060
Chattogram	: 01730-087718

Registered Office
Crown Chamber
325 Asadgonj, Chattogram–4000, Bangladesh
Tel: +880 31 631460
PABX: +880 31 2854997; Fax: +880 31 610995
E–mail: info@gphispat.com.bd

Dhaka Office
Hamid Tower (3rd & 11th floor)
24 Gulshan C/A, Circle–2, Dhaka–1212, Bangladesh
Tel: +88 02 222260177, 222280366
E–mail: salesdhk@gphispat.com.bd

Corporate Office & Plant
Masjiddah, Kumira, Sitakunda, Chattogram, Bangladesh
E–mail: factory@gphispat.com.bd