# PRESSURE PIPES

## GLASSFIBER REINFORCED PLASTICS (GRP)

Strong, Superior, Sustainable

subor®

Make a **Good Start**

# **SUBOR:**
# A GLOBAL AND RELIABLE SOLUTION PARTNER

SUBOR is a pioneer company in Glassfiber Reinforced Plastic (GRP) pipes manufacturing, founded in 1996. Having the privilege of using the Advanced Continuous Filament Winding Technology over 20 years, SUBOR offers long-term solutions for various infrastructure applications with its wide variety of product and service portfolio. As a reputable brand name with successful references in 5 continents and over 50 countries since its establishment, SUBOR continues to improve its global presence to enhance the quality of people's lives.

# WHY **SUBOR**

### PRESENCE IN 5 CONTINENTS
Reliable and long-life piping solutions enable civilizations in different territories to reach clean water and energy.

### EXPERIENCE
More than 10.000 km of SUBOR Pipes in various applications are serving the development of humankind, worldwide.

### FIELD SERVICE
By aiming to extend the service life of the pipe system with the correct installation in a cost-effective way, SUBOR is providing site supervision service all over the world ensuring the conformity with the technical specifications and standards.

### ENGINEERING AND R&D
SUBOR's in-house engineering department delivers the design works and calculations according to piping principles in each project, develops researches and innovates new products.

### HIGH PRODUCTION CAPACITY
With an installed manufacturing capacity of over 1.000 km pipes per year, SUBOR is one of the world's leading GRP pipe producers.

### EFFICIENT USE OF TRANSPORTATION
Wide experience in cost-efficient transportation solutions by means of truck, container, bulk-shipment, train and their combinations, together with the lightweight of GRP pipes enable the end-user to reach attractive freight charges globally.

### WIDE RANGE OF PRODUCTS IN PIPE SYSTEMS
SUBOR provides accurate solutions for a wide variety of projects by manufacturing pipes in a range between 200 mmand 4000 mm in diameter, up to 40 bar pressure and 1.000.000 N/m$^2$ stiffness.

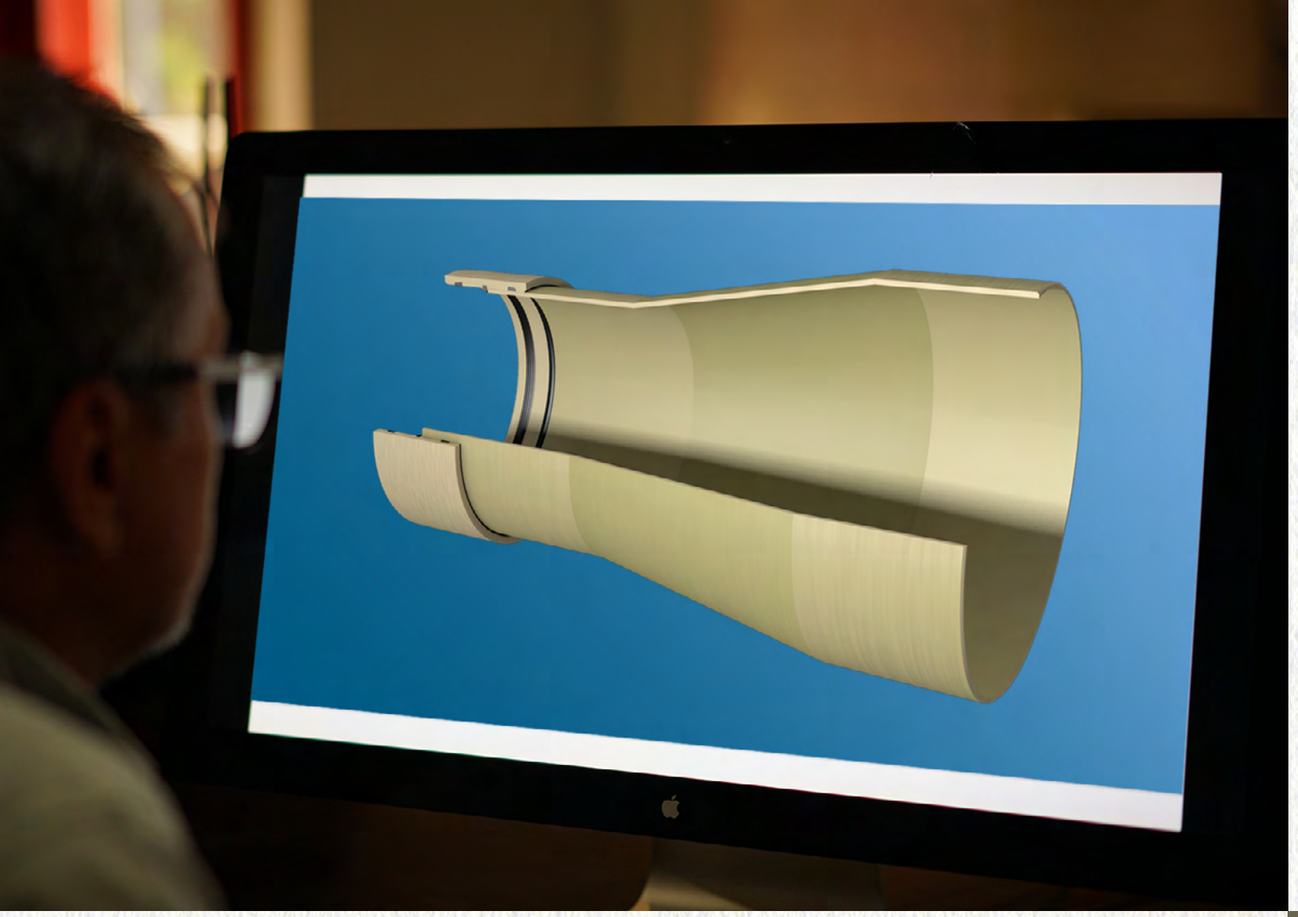
### NON-CORROSIVE MATERIALS
Corrosion, the major environmental risk imposed by pipeline projects is not a problem with GRP pipes. When it comes to long term use, GRP is your go-to option for both environmental and financial impact.

### ENVIRONMENT FRIENDLY
By aiming to leave a better world to the future, SUBOR accepts the principle of respecting the environment and nature in all of its processes within the awareness of environmental responsibility.

### QUALITY ASSURANCE
SUBOR GRP Pipes are designed and tested in compliance with the world's fundamental and acknowledged standards such as AWWA, ASTM, ISO, EN, DIN, BS.

### PROJECT FINANCE
SUBOR provides soft loan by international Export Credit Agencies to projects in order to accelerate the investment return.

### SUSTAINABLE INVESTMENT
Having a very low carbon footprint due to their high level of material efficiency, SUBOR GRP products are the best choice for the environment, compared to conventional pipe technologies.



# GRP:
# A SOLID CHOICE FOR LONG SERVICE LIFE

SUBOR's approach is to have a more sustainable business to undertake today's projects for future generations' needs. Sustainable development must consider the effects it has on the economy, society, and environment as a whole. SUBOR, as a pipe manufacturer calculates the influence of its outputs on these elements at every step of its decision-making process for a sustainable business.

The superior properties of GRP in terms of excellent hydraulic characteristics resulting in higher energy productivity and less pumping energy, high efficient production and transportation methods together with its long life cycle enable SUBOR to offer the utmost quality with better sustainability to the future. As a result of having very low envinomental impact compared to conventional pipe technologies due to its high level of material efficiency, SUBOR GRP products have low carbon footprint and offer the best choice for the environment.

# OUR ENGINEERING SERVICES:
# SUCCESS IS TEAMWORK

SUBOR provides engineering support to the customers before and after the procurement phase to ensure correct and efficient use of the products and technology offered with its in-house expert engineers by looking out for their maximum benefit.

- Stress and Flexibility Analysis of pipelines and stress isometric drawings
- Engineering drawings
    - Piping layout and isometric drawings
    - GRP component shop drawings
    - Conceptual support and clamp drawings
    - Connection detail with different materials
- Calculation of pipe anchoring and support requirements
- Calculation of concrete thrust blocks
- GRP tank, silo, manhole and spool design
- Buried pipe design
- Hydraulic calculations

# **BIG PROJECTS**
# REQUIRE BIG THINKING

# GRP
# SUPERIOR FEATURES

- Corrosion/abrasion resistance
- Lightweight
- Superior hydraulic properties
- Long service life
- Fast and easy installation
- High load capacity
- High UV resistance*
- High chemical resistance
- Simple handling
- Numerous fittings

*Please get in contact with SUBOR for further information.

# PRESSURE PIPES:
# THE PERFECT WAY TO CLEANWATER

The proven advanced continuous filament winding technology and the benefits of composite materials enable SUBOR to provide solutions for pressure pipe systems up to 40 bars with a cost advantage against conventional materials.

With the benefit of SUBOR GRP Pipes' structure, lower wave celerity than other piping materials can mean less cost when designing for surge and water hammer pressures.

## SUBOR PRESSURE PIPE

The proven advanced continuous filament winding technology and the benefits of composite materials enable SUBOR to provide solutions for pressure pipe systems up to 40 bars with a cost advantage against conventional materials. The wide product portfolio of SUBOR is also offering special designed GRP pipe for sewer applications. In order to resist against severe corrosive and with the benefit of SUBOR GRP Pipes' structure, lower wave celerity than other piping materials can mean less cost when designing for surge and water hammer pressures.

## SUBOR GRI PIPE

SUBOR provides a safe and more reliable option to engineers and contractors, who need higher resistant pipes for their tough project conditions. The recently developed SUBOR GRI Pipes reach an excellent performance when they are subjected to high abrasion, outer impacts, and highly pressurized water jet cleaning. SUBOR GRI Pipe technology allows to have same connection type and production range with standard pressure pipes.

## SUBOR BIAXIAL PIPE

SUBOR Biaxial Pipes are designed and produced to resist forces in axial direction as well as circumferential direction in order to eliminate thrust block needs. Loads are transferred from one pipe to the next with restrained joints such as butt-wrap lamination, lock joint or flanges. Stress analysis study which is necessary for biaxial systems can be performed by SUBOR Engineering Team.

## SUBOR JACKING PIPE

SUBOR is offering an innovative and reliable solution for urban areas by special design jacking pipes. SUBOR Jacking Pipes are used for the construction and renovation of underground pipelines using trenchless methods. High axial compressive strength of jacking pipes provides significant advantages compared to other pipe materials for micro tunneling and slip-lining applications. SUBOR Jacking Pipes are preferred in the construction of new sewer and pressure pipelines, replacement of old sewers, road culverts in transport engineering and relining using the Micro-tunneling and slip-lining methods. Depending on the project requirements, SUBOR Jacking Pipes are designed in custom lengths, with different joining types and up to 1.000.000 N/m2 nominal stiffness. Compared to conventional pipe materials, SUBOR GRP Pipes enable installer to use smaller capacity jacking machines, to minimize the excavation volume, to reduce energy consumption and to increase installation speed.

# WATER AND **AGRICULTURE**

Water is a critical input for agricultural production and it plays an important role in food security. In order to enrich agricultural production and provide quality water infrastructure, Subor has provided millions of kilometers of pipes to hundreds of irrigation projects to date.

# **FITTINGS:**
# FREEDOM TO CHOOSE

SUBOR GRP Pipes are also used to fabricate fittings such as elbow, tee, reduction, flange, marine lugs etc., as well as special spools that can be designed upon request. For the fitting production, firstly the pipes are cut at the desired angles and forms. Then, the cut pipes are attached by connecting glass fiber and polyester resin.

SUBOR GRP Pipes allow the production of standard fittings as well as non-standard ones in a very wide range. SUBOR offers wide solution opportunities with over 200.000 different types of fitting design.

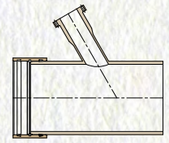
# **SUBOR**
# FITTING TYPES

CONCENTRIC & TANGENTIAL TEE

CONCENTRIC REDUCER

ECCENTRIC REDUCER

FLANGE



WYE

ELBOWS

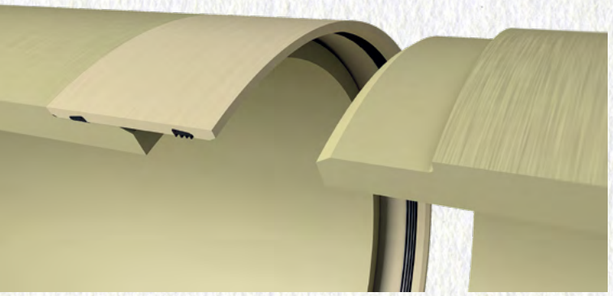
# COUPLINGS

SUBOR GRP Pipes are assembled using the GRP coupling connection system which offers perfect leak tightness. The GRP REKA couplings with the same technique as the GRP pipes and they are subjected to a hydrostatic pressure test following preparation in the cutting and grooving machine. Tightness of the coupling connections is provided by the gaskets made of elastomeric material.

The flexibility of the gaskets allows a certain angular deviation of the couplings, thus preventing direct load on the pipe, which could result from ground subsidence and soil activity such as earthquakes. Compared to its alternatives, SUBOR GRP Couplings offer fast, easy and safe installation in any ground and weather conditions.

**Angular deflection for standard SUBOR pressure coupling is given with below table:**

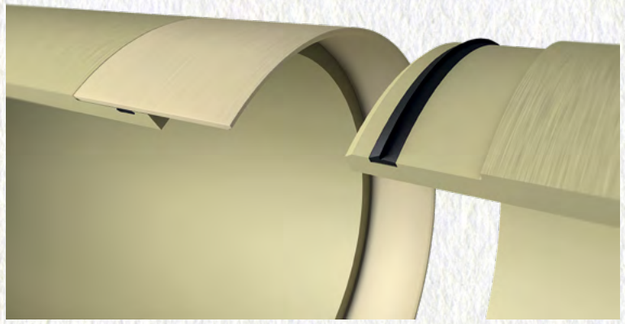
| Nom. Pipe Diameter (mm) | Nom. Pressure Class (bar) | | | |
|---|---|---|---|---|
| | Up to 16 | 20 | 25 | 32 |
| | | Max. Angle of Deflection (deg) | | |
| DN ≤ 500 | 3.0 | 2.5 | 2.0 | 1.5 |
| 500 < DN ≤ 900 | 2.0 | 1.5 | 1.3 | 1.0 |
| 900 < DN ≤ 1800 | 1.0 | 0.8 | 0.5 | 0.5 |
| 1800 < DN | 0.5 | 0.4 | 0.3 | NA |



## SPC JOINT

- Includes a Reka Type GRP pressure coupling design.
- Suitable for use in pressure applications.
- Suitable for installations with lower jacking forces.

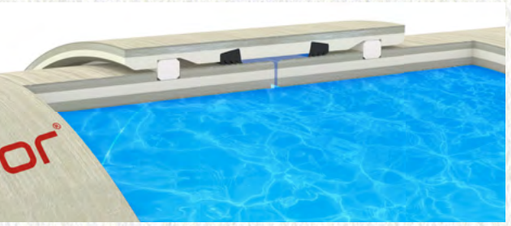
**MAX. PN:** 16 BAR



## SGR JOINT

- Includes a GRP sleeve with EPDM rubber gasket that fits into the grooves in the pipe spigots.
- Suitable for use in pressure and non-pressure applications.
- Can be produced in any diameter to suit your project and installation needs.

**MAX. PN:** 6 BAR



## BIAXIAL LOCK JOINT

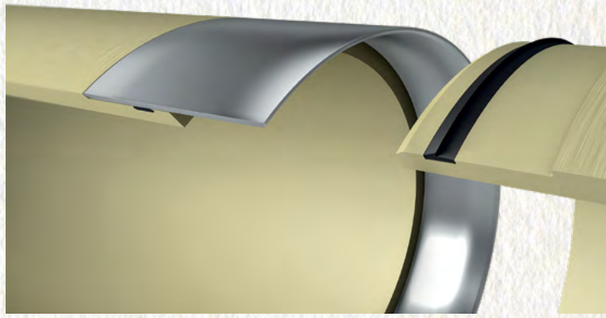
- Common applications include industrial cooling and desalination systems.
- DN200 – DN4000 mm diameter range.

**MAX. PN:** 16 BAR

## SSR JOINT

- Includes a stainless steel sleeve whose inner surface fits tightly to the EPDM rubber gasket in the groove on the pipe spigot.
- Suitable for pressure and non-pressure applications.
- Often preferred for smaller diameter pipes.

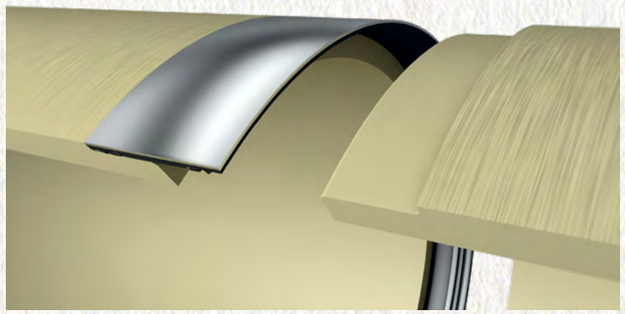
**MAX. PN:** 6 BAR



## ANGLED COUPLING

- Cost effective coupling solution for increased angular deflections up to 3 °C.
- DN200 – DN4000 mm diameter range.

**MAX. PN:** 16 BAR



## SSE JOINT

- Includes a stainless steel sleeve with an integrated EPDM rubber seal.
- Suitable for pressure and non-pressure applications.
- Resistant to high jacking forces during installation.

**MAX. PN:** 10 BAR

# SUBOR
# BLUE TAPE COUPLING

No stain, no dirt, no rust! To have an easier and faster installation, **just remove the blue!**

In order to prevent EPDM Gaskets from direct UV effect of the sunlight, it is recommended to supply them separately and store them in a proper place.

SUBOR's new innovative product BLUE TAPE offers a perfect solution for the installers and avoids the need for storage space. SUBOR Blue Tape also provides long-lasting protection against both UV and environmental effects like dust and dirt.


JUST REMOVE
**BLUE**

# QUALITY MANAGEMENT SYSTEM

SUBOR's approach to the quality concept is not limited to the production process and its product. The management mindset of SUBOR in all activities is an insight that considers the satisfaction of all stakeholders, especially customers and adopts environmental awareness, occupational health and safety, and information security as the fundamental policy.

Establishing its management systems on these foundations, SUBOR has obtained **ISO 9001 Quality**, **ISO 14001 Environment**, **OHSAS 18001 Occupational Health and Safety**, **ISO 17025 Testing and Calibration Laboratories and ISO 27001 Information Security Management Systems** certificates as a result of the audits of international institutions.

| | |
|---|---|
| **ISO 25780** | Plastics piping systems for pressure and non-pressure water supply, irrigation, drainage or sewerage – Glass reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin – Pipes with flexible joints intended to be installed using jacking techniques. |
| **ISO 10467** | Plastics piping systems – Glass reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin: Pressure and non-pressure drainage and sewerage. |
| **ISO 10639** | Plastics piping systems – Glass reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin: Pressure and non-pressure water supply. |
| **EN 1796** | Plastics piping systems for water supply with or without pressure – Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP). |
| **NS-EN 14364** | Plastics piping systems for drainage and sewerage with or without pressure - Glass-reinforced thermosetting plastic (GRP) based on unsaturated polyester resin (UP) – Specifications for pipes, fittings and joints. |

# QUALIFICATION TESTS

## STRAIN CORROSION TEST

The method evaluates the effect of a chemical environment on the pipe when in a deflected condition. It has been found that the effects of chemical environments can be accelerated by strain induced by deflection. This test is performed by applying sulphuric acid solution in accordance with ASTM D 3681 standard.

## HYDROSTATIC DESIGN BASIS (HDB) TEST

This practice is useful for establishing the hoop stress or internal pressure versus time-to-failure relationships, under selected internal and external environments which simulate actual anticipated product end-use conditions, from which a design basis for specific piping products and materials can be obtained. This test is applied in accordance with ASTM D 2992 standard.

## JOINT QUALIFICATION TEST

Various joint qualification tests are applied according to international standards such as EN 1119 and ASTM D 4161, to find out the performance of the joint.

## LONG-TERM BENDING STRAIN TEST

Long term ring bending strain test method determines the long-term ring-bending strain of pipe when deflected under constant load and immersed in a chemical environment. It has been found that effects of chemical environments can be accelerated by strain induced by deflection. This test is applied in accordance with ASTM D 5365 standard.

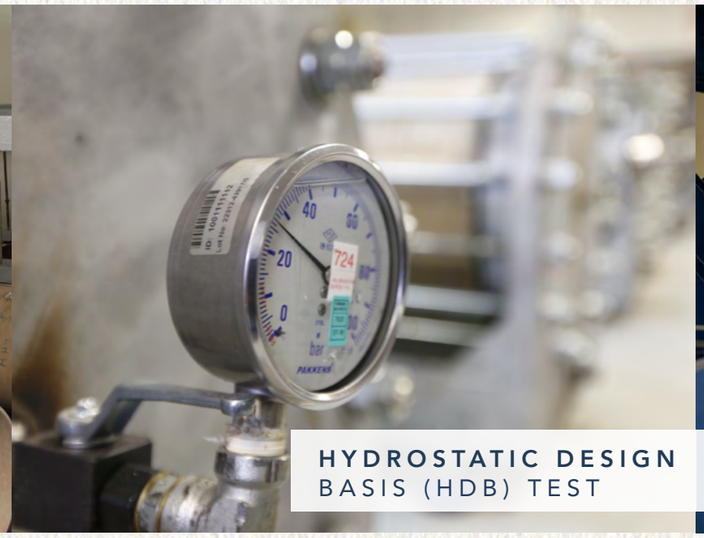
## LONG-TERM SPECIFIC RING STIFFNESS TEST

The test is applied for determining the ring creep properties for glass-reinforced thermosetting plastics (GRP) pipes. Properties include the wet creep factor and the long-term specific creep stiffness. This test is applied in accordance with ISO 10468 standard.

## ABRASION RESISTANCE TEST

The abrasion resistance of the pipe is tested according to CEN/TR 15729. The method for this test has been released by Darmstadt University. The test is carried out by adding a gravel mixture with water inside the pipe sample and cycling it within certain times to determine the abrasion level of liner layer of the pipe.

**STRAIN** CORROSION TEST



**HYDROSTATIC DESIGN** BASIS (HDB) TEST

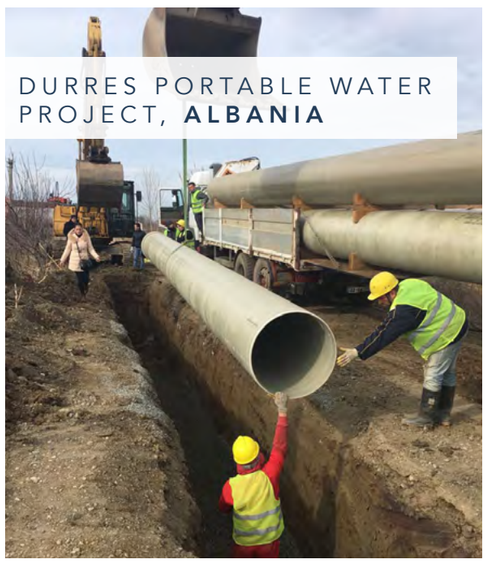
**LONG-TERM** BENDING STRAIN TEST

**LONG-TERM** SPECIFIC RING STIFFNESS TEST

PTOLEMAIS V POWER PLANT PROJECT, **GREECE**

URFA IRRIGATION PROJECT **TURKEY**

LISINE SHP PROJECT **SERBIA**



DURRES PORTABLE WATER PROJECT, **ALBANIA**

EAST IMPROVEMENT DISTRICT IRRIGATION PROJECT, **USA**

KONYA IRRIGATION PROJECT **TURKEY**

SAMSUN POWER PLANT PROJECT **TURKEY**

SALT LAKE UNDERGROUND STORAGE FACILTY PROJECT, **TURKEY**

KUROW DUNTROON IRRIGATION PROJECT, **NEW ZEALAND**

BACAU PORTABLE WATER PROJECT, **ROMANIA**

COLUMBIA IMPROVEMENT DISTRICT IRRIGATION PROJECT, **USA**

RWANGAZU IRRIGATION PROJECT, **UGANDA**

PARIS RAW WATER SLIPENNING PROJECT, **FRANCE**

KONYA KOS IRRIGATION PROJECT, **TURKEY**

MARY COMBINED CENTRAL POWER PLANT, **TURKMENISTAN**

RUMAILAH CCPP PROJECT, **IRAQ**

# 5 CONTINENTS,
# 60+ COUNTRIES!

subor®

*Make a* ***Good Start***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