**HYPERSEN**

# 6–Axis Force Torque Sensor

## High accuracy
## Ultra-low temperature drift
## Anti-overload Capacity: 350%

Medical Industry

Aotomotive Industry

Scientific Research

Safe Area Protection

HPS-FT120
6D FORCE TORQUE SENSOR

HPS-FT060E
6D FORCE TORQUE SENSOR

HPS-FT060S
6D FORCE TORQUE SENSOR

High static overload protection

High speed ADC sampling: 24Bit

Data output rate: 2000Hz

High signal-to-noise ratio

Optimized strain gauge measurement structure

Built-in decoupling, filtering and temperature compensation algorithm

Low zero drift, temperature drift and crosstalk

## ◎ Product Description

• The HPS-FT series sensors are high-performance digital six-axis force torque sensors that can accurately measure the force and torque on the three spatial coordinate axes of X, Y, and Z. The sensors adopt strain gauge structure that can withstand up to 3.5 times of safe overload during operation thanks to its anti-overload capability and durability.

• High-precision strain gauge and structure design help the sensor achieve higher signal-to-noise ratio and sensitivity. Besides, the built-in temperature algorithm highly reduces temperature drift caused by temperature changes.

• 6-axis force torque sensors can be mounted on industrial robots, collaborative robots, exoskeleton robots and medical rehabilitation robots. They are also widely used in flexible gripper grasping, robot joints, automatic measurement and control, wind tunnel testing and other scenarios.

6–Axis Force Torque Sensor

**Hypersen**

3D Line Confocal Sensor

Chromatic Confocal Sensor

High Speed Industrial Camera

**6–Axis Force Torque Sensor**

3D Vision Autonomous Grasping

Laser Cross Beam Sensor

3D Solid-state LiDAR

ToF Ranging Sensor

Laser Displacement Sensor

## • HPS−FT025

The model HPS-FT025 weighs only 28g with the size of 23*26.2mm (diameter). It is made of alloy steel and aviation aluminum materials. Besides, it enjoys the following advantages: the maximum data output rate: 2000Hz; protection degree: IP65; hysteresis: 0.1 (%F.S); anti-overload capacity: 350%.
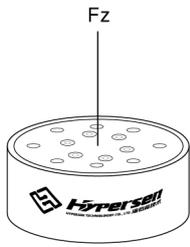
## • HPS−FT060E

The model HPS-FT060E weighs only 255g with the size of 87*78*28.5mm. It is made of alloy steel and aviation aluminum materials. Besides, it enjoys the following advantages: the maximum data output rate: 2000Hz; protection degree: IP65; hysteresis: 0.1 (%F.S); anti-overload capacity: 350%.

## • HPS−FT060S

The model HPS-FT060S weighs only 265g with the size of 87*78 (diameter)*28.5mm. It is made of alloy steel and aviation aluminum materials. Besides, it enjoys the following advantages: the maximum data output rate: 2000Hz; protection degree: IP65; hysteresis: 0.1 (%F.S); anti-overload capacity: 350%.

## • HPS−FT120

The model HPS-FT060S weighs only 1,450g with the size of 142*126*49.9mm. It is made of alloy steel. Besides, it enjoys the following advantages: the maximum data output rate: 2000Hz; protection degree: IP65; hysteresis: 0.1 (%F.S); anti-overload capacity: 350%.
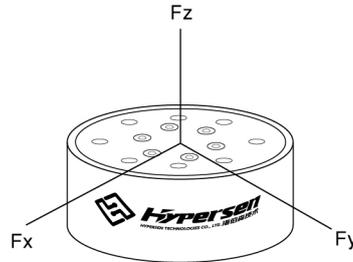
# What is a force sensor?

1. A force sensor is a device that converts force changes into electrical signals.

2. Classification of force sensors: According to the different number of dimensions of the force being measured, force sensors can be divided into single-axis force sensor and multi-axis force sensor.

A single-axis force sensor means that it can measure force or torque in one direction.

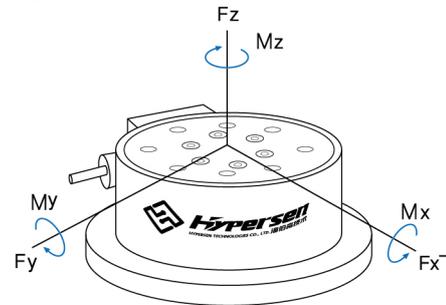3. Multi-axis force sensor means that it can measure force or torque in multiple directions.

| Single-Axis Force Sensor | 3-Axis Force Sensor | 6-Axis Force Torque Sensor |
|---|---|---|
| A single-axis force sensor can measure force or torque in one direction. For example, the force in Z axis. | A sensor that measures force in three directions in a Cartesian coordinate system. For example, Fx, Fy, Fz. | It refers to a device that can measure three force components (Fx, Fy, Fz) (Right-handed coordinates) and three moment components (Mx, My, Mz) (Left-handed coordinates) in real time in Cartesian coordinate system and convert these six components into electrical signals. |

# Features of the 6-Axis Force Torque Sensor

1. It's a hardware that can provide the force and torque feedback in three directions, which is widely used in different scenarios such as robot control, mechanics experiments, and scientific research. Different from other common single-axis and 3-axis force sensors, the 6-axis force torque sensor can measure six-degrees-of-freedom environmental force data completely, making it suitable for more applications.

2. The 6-axis force torque sensor enables the robots to have a real "sense of touch" and realizes the closed-loop feedback with the robot's motion posture and the visual system, improving the accuracy and flexibility. It can adapt quickly and accurately to the surface contour and continuity of the materials or parts being processed, which can reduce the cost and increase efficiency by improving the processing effect and product quality, and shortening the cycle time.

3. The 6-axis force torque sensor features high-precision force control in the end part of a robot because it's often installed there. It's easy to develop, but the control bandwidth is narrow. Therefore, when there is a high requirement on the Takt Time, we need to perform initial vision positioning and use the six-axis force torque sensor in combination, which can not only ensure high-precision operation, but also make up for the insufficient time.

Excellent performance to deal with different scenarios

# Product Advantages

## Ultra-low temperature drift

HPS-FT series 6-axis force torque sensors employ built-in temperature compensation algorithms to reduce the temperature drift greatly caused by temperature changes.

## Protection degree: IP65

HPS-FT series 6-axis force torque sensors have excellent Ingress protection rating of IP65, which can prevent foreign objects and dust from entering and are stable and reliable. Besides, anti-dropping aviation plug is employed.

## High sampling frequency: 2000Hz

HPS-FT series 6-axis force torque sensors have ultra-high-speed sampling frequency (24Bit high speed ADC sampling) with the hysteresis of only 0.1 (%F.S) and data output frequency at 2000Hz. The sensors support Ethernet / EtherCAT / RS-485 / and analog interface output.

**350%**
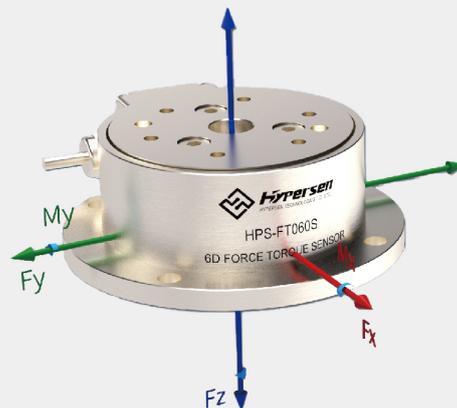
## Anti-Overload Capacity:350%

HPS-FT series 6-axis force torque sensors enjoy super anti-overload capacity by adopting excellent materials and structure, which can withstand 350% overload under normal conditions.

## Real-time data display

The data can be read and displayed in real time by HPS client software, which is convenient for users to debug and analyze data.
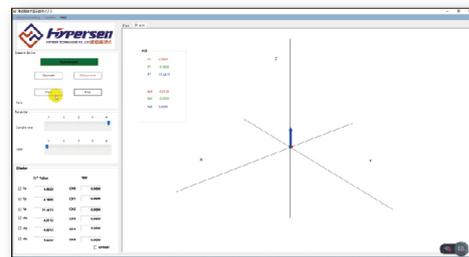
## High linearity & Low crosstalk

High linearity of measurement results and extremely low crosstalk can be achieved through built-in high-performance embedded microprocessor, advanced embedded data processing, filtering and decoupling algorithms.
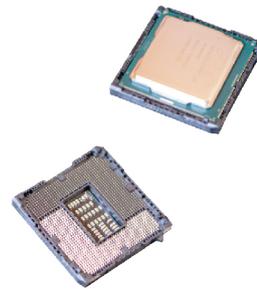
## IO output for emergency stop

Hypersen 6-axis force torque sensor can be used with EtherCAT and Ethernet adaptor. The IO of the adaptor can be connected to the emergency stop IO of the robot. After setting the alarm threshold, the adaptor can stop the robot within 0.5ms by IO signal to prevent damage to the sensor and workpiece when the force in a certain direction exceeds the set threshold.

0.5ms

**STOP**

6-Axis Force Torque Sensor

Hypersen

# Applications

## Assembly Industry

01-01

• Force-controlled grasping

01-02

• Precise assembly

01-03
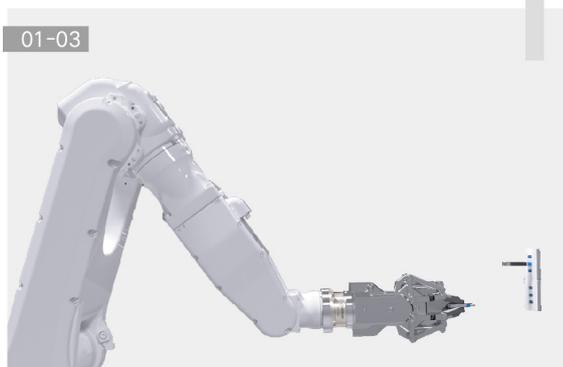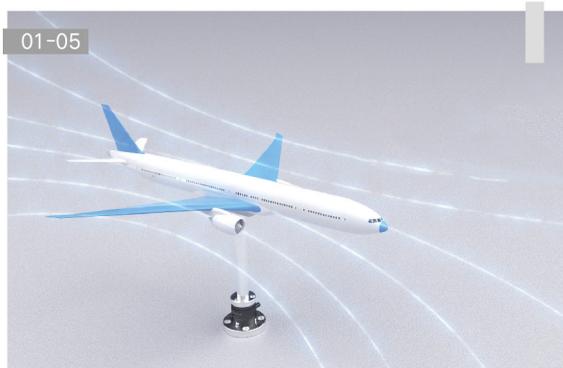
• Force-controlled insertion

01-04

• Palletizing & depalletizing

01-05

• Wind tunnel test

**Excellent performance to deal with different scenarios**

# Applications

## Medical/Grinding/Depalletizing Industry

02-01

• Turning screws

02-02

• Humanoid robot

02-03

• Medical rehabilitation robot

02-04

• Robot hand guiding

02-05

• Precise grinding

3D Line
Confocal Sensor

Chromatic
Confocal Sensor

High Speed
Industrial Camera

**6-Axis Force
Torque Sensor**

3D Vision Auton-
omous Grasping

Laser Cross
Beam Sensor

3D Solid-
state LiDAR

ToF Ranging Sensor

Laser Displacement
Sensor

# Applications
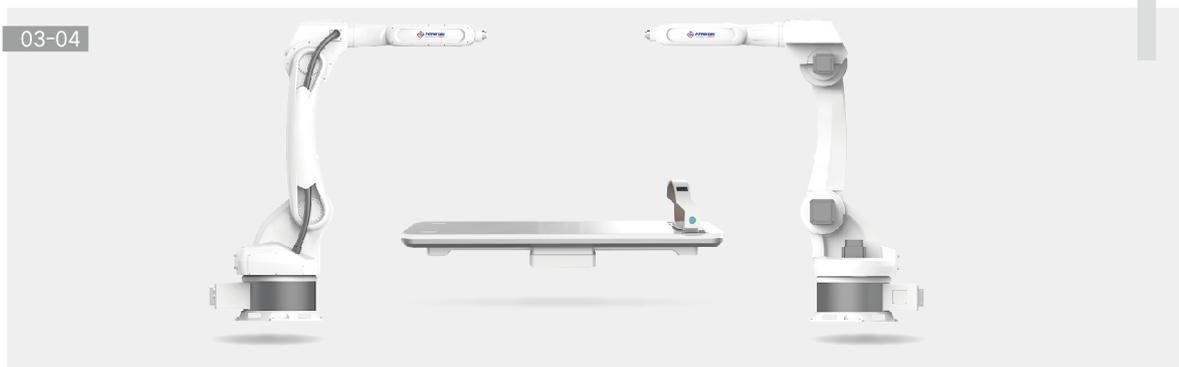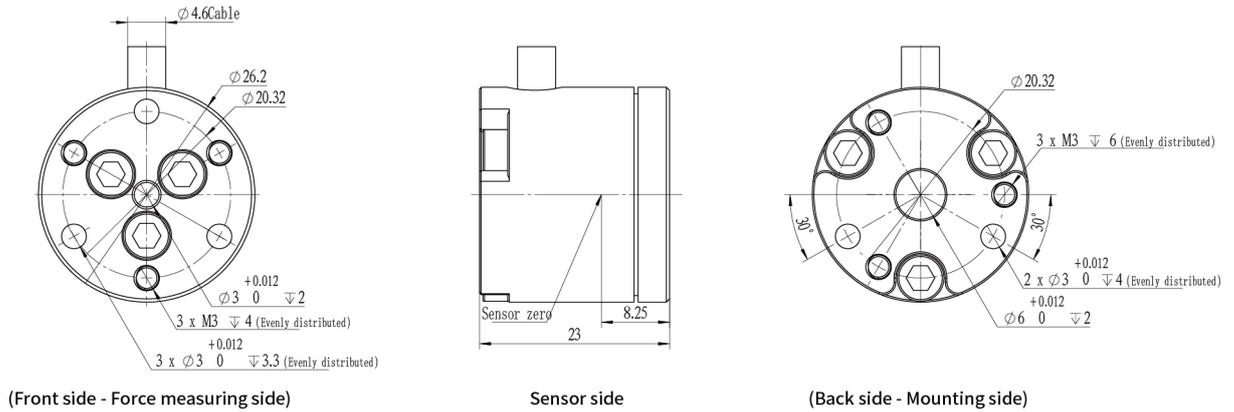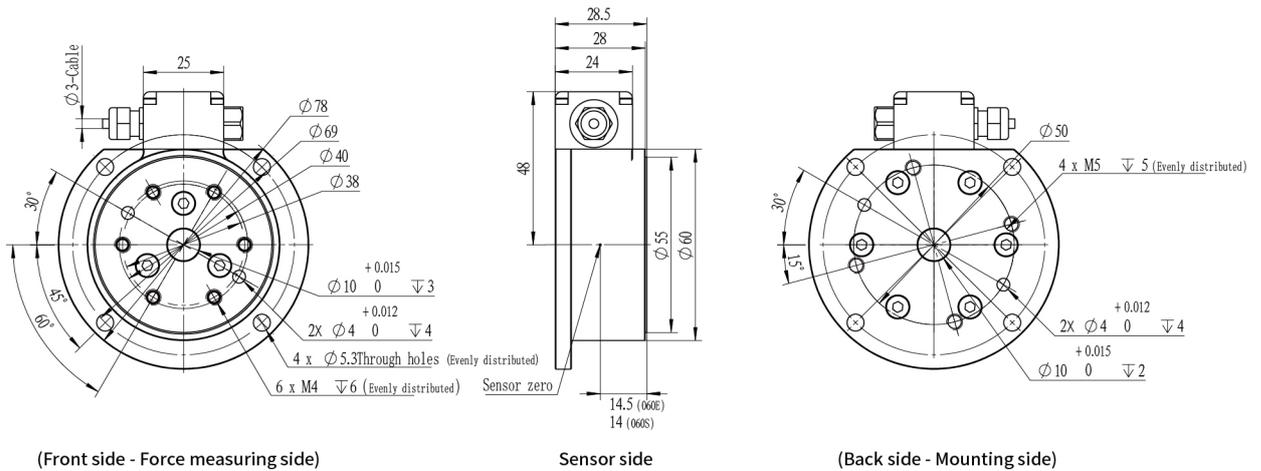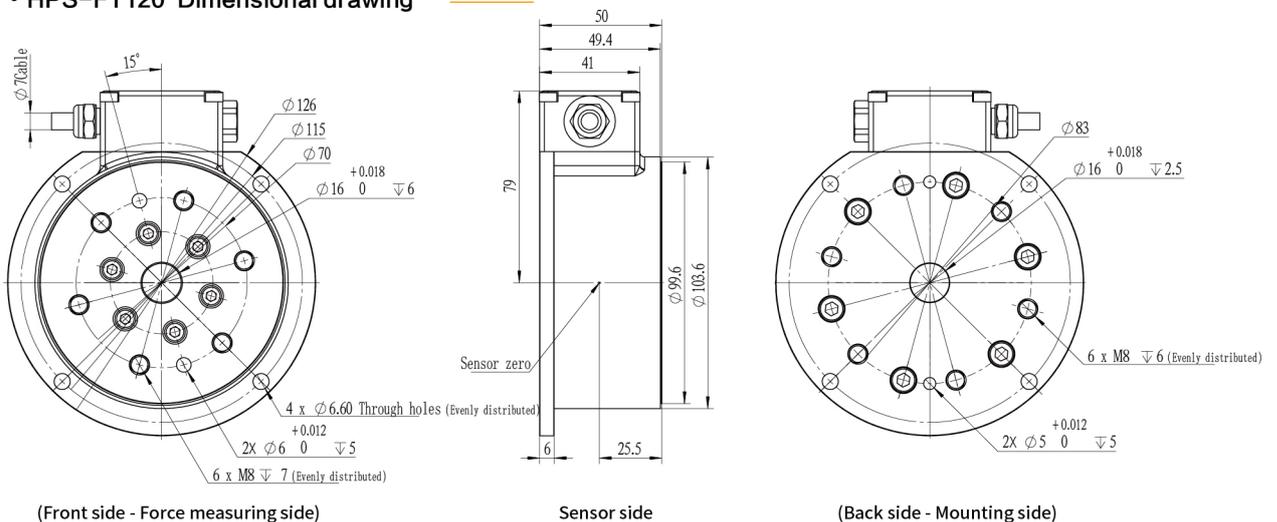
## Scientific Research

03-01

• Overload protection

03-02

• Manipulator motion force test

03-03

• Mechanics experiment and scientific research

03-04

• Surgical machine

## Technical Parameters

| Model | HPS-FT025 | Operating temperature | -10~55°C |
|---|---|---|---|
| System structure | Digital output + Adaptor | Power consumption | 0.5W |
| Measuring range | ±150N(Fxy) | Communication interface | Ethernet. EtherCAT.RS485. Analog output |
| | ±200N(Fz) | Weight | 28g |
| | ±4Nm(Mxy) | Size | 23*26.2mm(diameter) |
| | ±4Nm(Mz) | Power supply | 12-24V |
| Precision | 0.05N(Fxy) | External connector type | Cold-pressed terminal |
| | 0.05N(Fz) | Data output rate | 2000Hz（max) |
| | 0.001Nm(Mxy) | Protection degree | IP65 (Customizable: IP67) |
| | 0.001Nm(Mz) | Hysteresis | 0.1(%F.S.) |
| Non-linearity | <1.25% | Overload | 500% |
| Creep (Z axis) | <2% | Signal noise | 0.05N(x,y) |
| Crosstalk | <2(%F.S) | | 0.08N(z) |

| Model | HPS-FT060E | Operating temperature | -10~55°C |
|---|---|---|---|
| System structure | Digital output + Adaptor | Power consumption | 0.5W |
| Measuring range | ±600N(Fxy) | Communication interface | Ethernet. EtherCAT.RS485. Analog output |
| | ±800N(Fz) | Weight | 255g |
| | ±15Nm(Mxy) | Size | 87*78*28.5mm |
| | ±15Nm(Mz) | Power supply | 12-24V |
| Precision | 0.2N(Fxy) | External connector type | Cold-pressed terminal |
| | 0.4N(Fz) | Data output rate | 2000Hz（max) |
| | 0.002Nm(Mxy) | Protection degree | IP65 (Customizable:IP67) |
| | 0.002Nm(Mz) | Hysteresis | 0.1(%F.S.) |
| Non-linearity | <1.25% | Overload | 500% |
| Creep (Z axis) | <2% | Signal noise | 0.03N(x,y) |
| Crosstalk | <2(%F.S) | | 0.12N(z) |

| Model | HPS-FT060S | Operating temperature | -10~55°C |
|---|---|---|---|
| System structure | Digital output + Adaptor | Power consumption | 0.5W |
| Measuring range | ±1000N(Fxy) | Communication interface | Ethernet. EtherCAT.RS485. Analog output |
| | ±1400N(Fz) | Weight | 465g |
| | ±30Nm(Mxy) | Size | 87*78( diameter )*28.5mm |
| | ±30Nm(Mz) | Power supply | 12-24V |
| Precision | 0.5N(Fxy) | External connector type | Cold-pressed terminal |
| | 0.5N(Fz) | Data output rate | 2000Hz（max) |
| | 0.004Nm(Mxy) | Protection degree | IP65 (Customizable:IP67) |
| | 0.004Nm(Mz) | Hysteresis | 0.1(%F.S.) |
| Non-linearity | <1.25% | Overload | 400% |
| Creep (Z axis) | <2% | Signal noise | 0.03N(x,y) |
| Crosstalk | <2(%F.S) | | 0.12N(z) |

| Model | HPS-FT120 | Operating temperature | -10~55°C |
|---|---|---|---|
| System structure | Digital output + Adaptor | Power consumption | 0.5W |
| Measuring range | ±3000N(Fxy) | Communication interface | Ethernet. EtherCAT.RS485. Analog output |
| | ±4000N(Fz) | Weight | 1450g |
| | ±150Nm(Mxy) | Size | 142*126*49.9mm |
| | ±150Nm(Mz) | Power supply | 12-24V |
| Precision | 1.5N(Fxy) | External connector type | Cold-pressed terminal |
| | 1.5N(Fz) | Data output rate | 2000Hz（max) |
| | 0.02Nm(Mxy) | Protection degree | IP65 (Customizable:IP67) |
| | 0.02Nm(Mz) | Hysteresis | 0.1(%F.S.) |
| Non-linearity | <2% | Overload | 400% |
| Creep (Z axis) | <2% | Signal noise | 0.03N(x,y) |
| Crosstalk | <2(%F.S) | | 0.12N(z) |

# Dimensions

## • HPS−FT025 Dimensional drawing



(Front side - Force measuring side)     Sensor side     (Back side - Mounting side)

## • HPS−FT060E/060S Dimensional drawing



(Front side - Force measuring side)     Sensor side     (Back side - Mounting side)

## • HPS−FT120 Dimensional drawing



(Front side - Force measuring side)     Sensor side     (Back side - Mounting side)
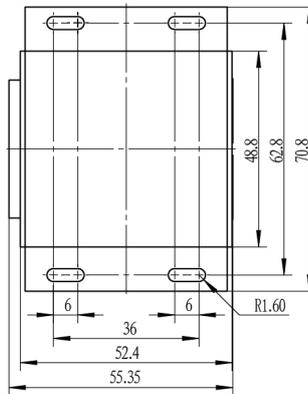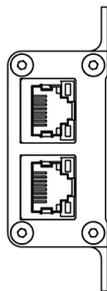
## Selection Guide

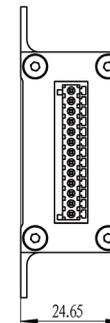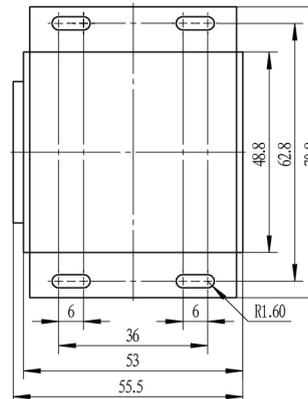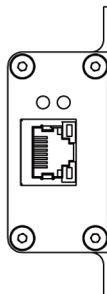| HPS−FT025 | HPS−FT060E | HPS−FT060S | HPS−FT120 |
|---|---|---|---|
| High accuracy; relatively limited force and torque measuring range, suitable for other high-precision force control application scenarios such as surgical robots. | Mounting flange included; suitable for most industrial application scenarios (no heavy load); material: aviation aluminum shell. | Mounting flange included; suitable for most industrial applications (no heavy load); material: stainless steel | Mounting flange included; large measuring range; suitable for industrial application scenarios with heavy load. |
| Static anti-overload capability: 350% | Static anti-overload capability: 350% | Static anti-overload capability: 350% | Static anti-overload capability: 350% |
| Optional interfaces: Ethernet, EtherCAT, RS485, analog signal output, etc. | | | |

## Adapter(Optional)

ETHERCAT

ETHERNET

48.8
62.8
70.8

6   6   R1.60

36
52.4
55.35

24.65

48.8
62.8
70.8

6   6   R1.60

36
53
55.5

24.65

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