



# TOYOTA MOTORSPORT GmbH HYDRAULIC DEVELOPMENT





TOYOTA MOTORSPORT GmbH  
THE HOME OF HIGH PERFORMANCE

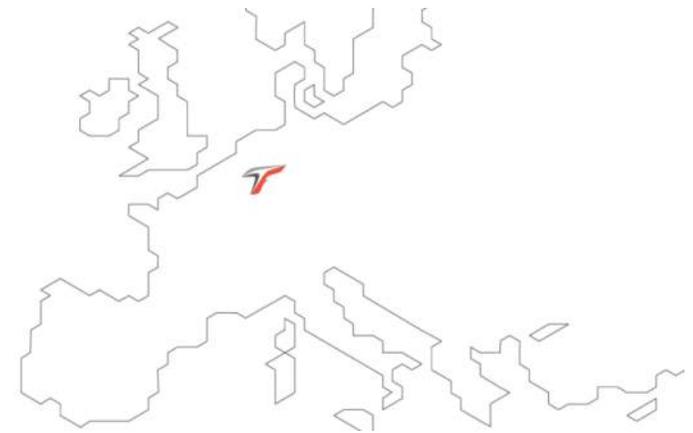
**Toyota Motorsport GmbH (TMG) is a unique high-performance development, testing and manufacturing facility located in the centre of Europe; in Cologne, Germany.**

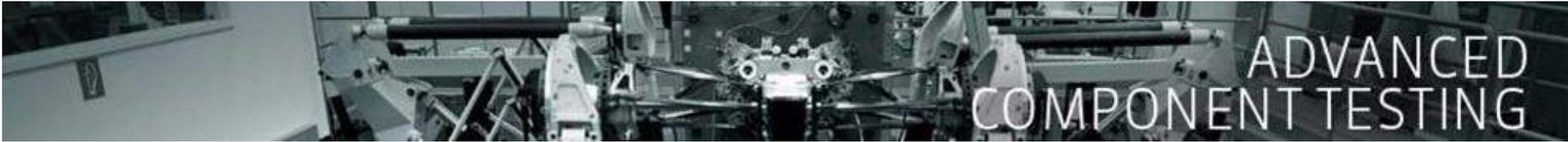
Flexibility, precision and high performance are basic principles at TMG and our technical specialists have in-depth engineering experience across various sectors.

Our hydraulic services are part of TMG's advanced component testing facility, which covers 2,600m<sup>2</sup> and can conduct over 200 specialised tests.

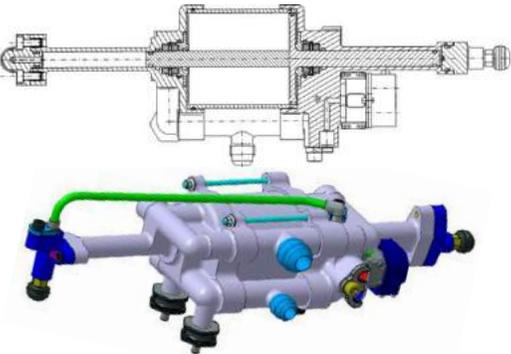
With nine years of Formula 1 experience, our hydraulic specialists have refined their considerable knowledge and detailed processes to ensure peak performance without compromise on overall car weight, functionality or reliability.

To complement our experienced personnel, TMG has a comprehensive range of test rigs which recreate all aspects of the driving experience for a car's hydraulic systems to give peace of mind before your car even turns a wheel.





# HYDRAULIC SYSTEM DEVELOPMENT



### CONCEPT AND DESIGN:

Lightweight

Efficient

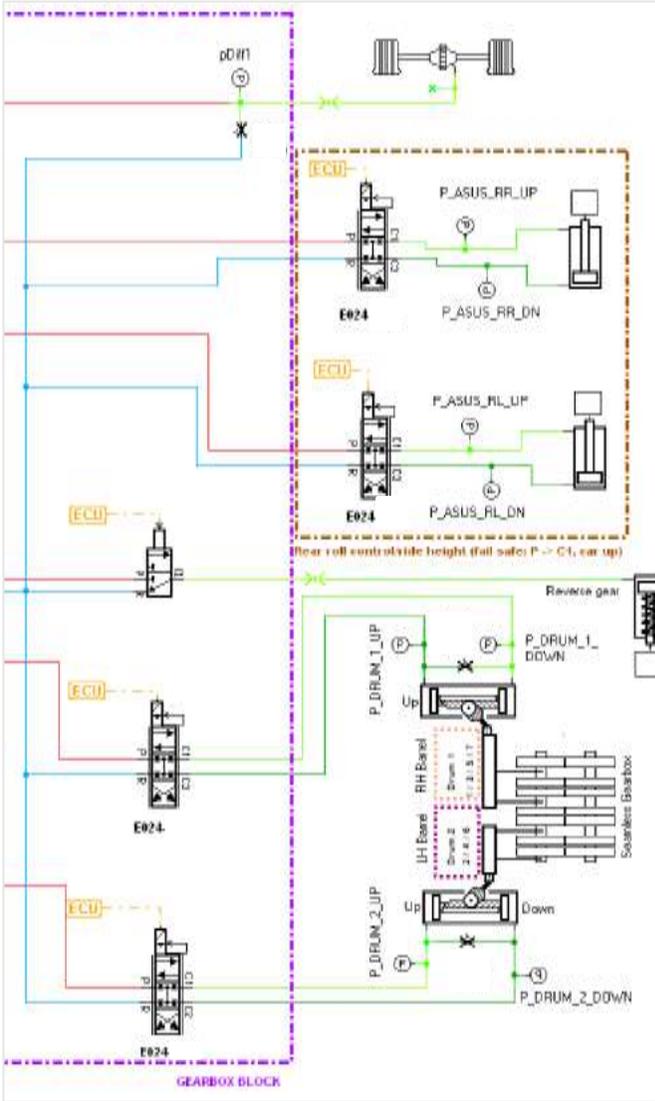
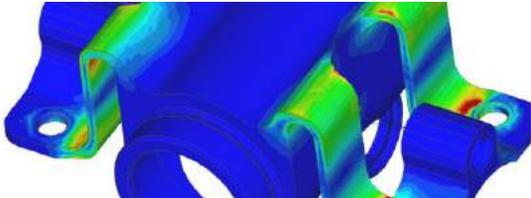
Catia V5

High pressure

### CALCULATION/SIMULATION:

Hydraulic system simulation

FEM calculation



### PROTOTYPES AND TESTING

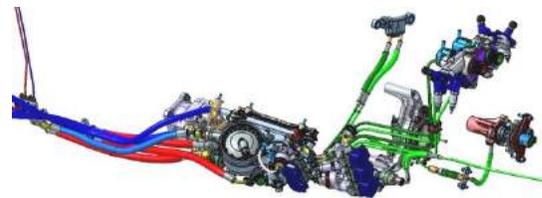
Prototype production

System assembly and set-up

Part testing

System performance tests

System optimisation





## SERVO VALVE TESTER



### Static testing

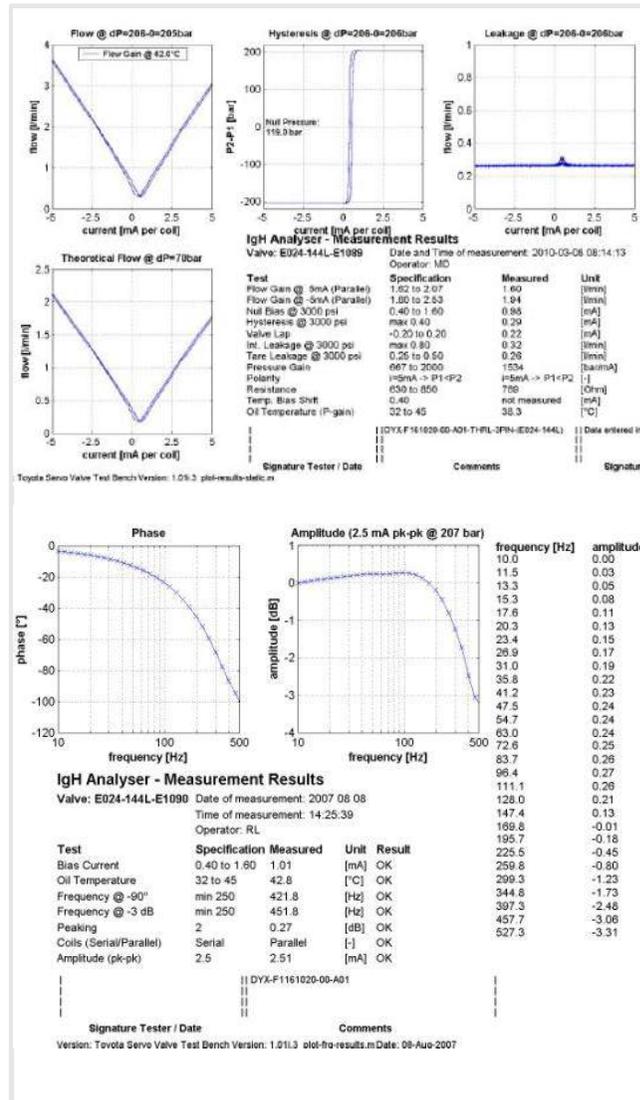
Dynamic testing (frequency response)

### Reliability and functionality checks

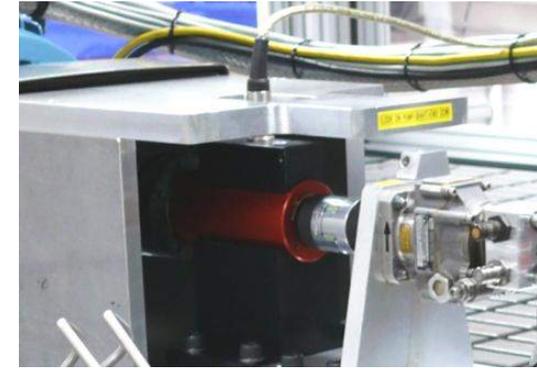
Designed for Moog servo valves (E024 and E050 series)

### Adaptable for other valves

Automatic data analysis and evaluation (bias, hysteresis, leakage, flow gain etc)



## HYDRAULIC PUMP TEST RIG



### Electric motor drive with computer-controlled speed

Performance tests for high-pressure hydraulic pumps

### Up to 250 bar of pressure

Up to 10,000rpm

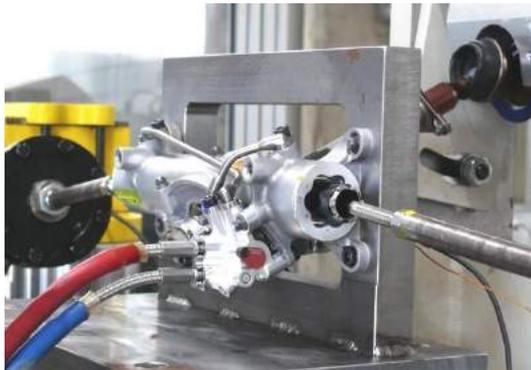
### Variable turning direction

Conditioned oil for realistic operating conditions

### Adaptable to all pump types



## POWER STEERING RIGS



### Linear spool valve set-up

Hydraulic power steering set-up and optimisation

### Manual steering option to evaluate steering 'feel'

Test rig for durability testing

### Conditioned power packs

Suspension, turning and driving torque simulation on test rig

### Simulated car data allows 'super lap' testing



Dynamic Power Steering Rig	
Track Width	1000-1400mm
Recession/Precession	±220mm
Vertical Displacement	±50mm
Vertical Acceleration	25g
Lateral Displacement	±60mm
Lateral Force	±10 kN
Steer Input Velocity	2000°/s
Steer Input Torque	±70Nm

## HYDRAULIC POWER PACKS



### Hydraulic pump substitute for component testing

Conditioned flow rate

### Conditioned oil temperature

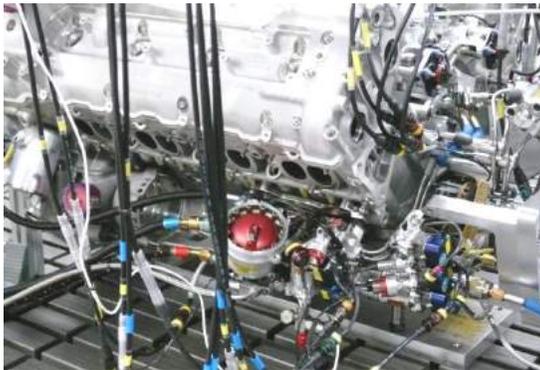
Compatible with all hydraulic systems

### Several units at TMG





## FULL HYDRAULIC SYSTEM TEST BENCH



### **Performance and reliability testing**

Clutch actuator testing

### **Hydraulic and sub system testing**

High temperature tests with oil temperatures up to 180°C

### **Dummy gearbox for gearshift actuator analysis**

Optimisation of control parameters

### **High sensor capacity**



### **50 channels**

Electro motor-driven hydraulic pump (up to 10,000 rpm)

### **Control of six servo valves**

Oil pressure and temperature measurements at various positions

### **Oil flow rate measurements**

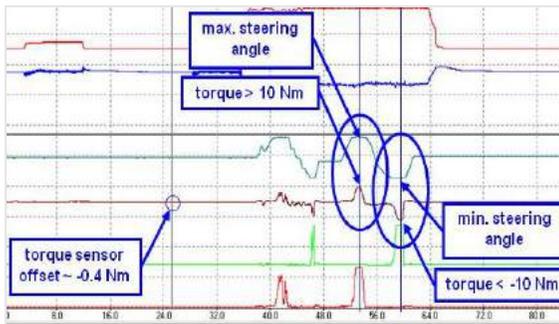
Various displacement sensors

### **Remote/independent operation**

Developed in-house by TMG



## MOTORSPORT APPLICATIONS



### SYSTEM CHECK:

Bespoke operating manual for complete systems

**Based on common data available from the car in all conditions - no additional sensors required**

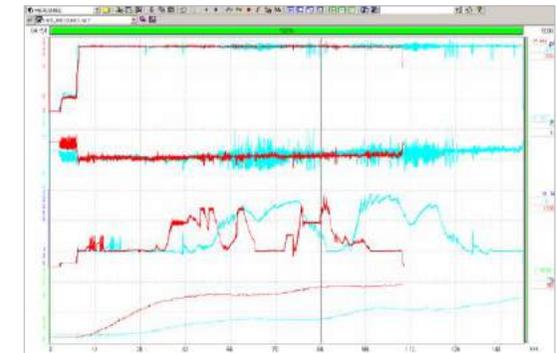
Leakage warning system

**Car hydraulics condition monitoring**

Confirms full functionality before leaving the garage

**Isolates and confirms problems very quickly**

Includes relevant schematics



### DATA EVALUATION SOFTWARE:

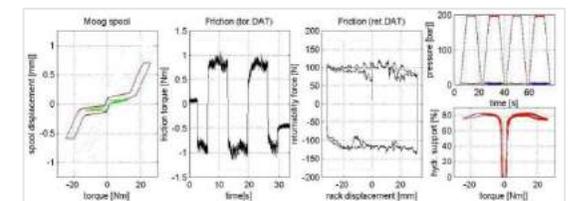
Designed for use with only commonly-available car data

**Understanding of on-track hydraulic performance**

Pressure analysis

**Hydraulic flow rate estimation based only on car data**

Accumulator pressure evaluation





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**With so many specialist services on offer, this presentation can only give an overview. So for a detailed discussion on how to extract the full potential of your project or product we are happy to offer a no-obligation consultation.**

As a multi-national company we have representatives speaking all major European languages and several more besides, while discretion and client confidentiality come as standard.

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