Four Ball Tester

TR 30 Series

Special Features

- CE Marked
- EP and WP test in 1 machine
- Computer controlled operation
- Facility to document test results
- Comparative viewing of test results
- CCD Image Acquisition System (optional)
- Modular electronics for ease in servicing
- Ergonomically designed for comfortable use
- Inbuilt storage for Accessories, Tools and Samples (dead weight loading option only)
- Safety interlocks for the safety of both users and machine
- Quick onsite re-calibration
- Retractable wheels for easy relocation

Description

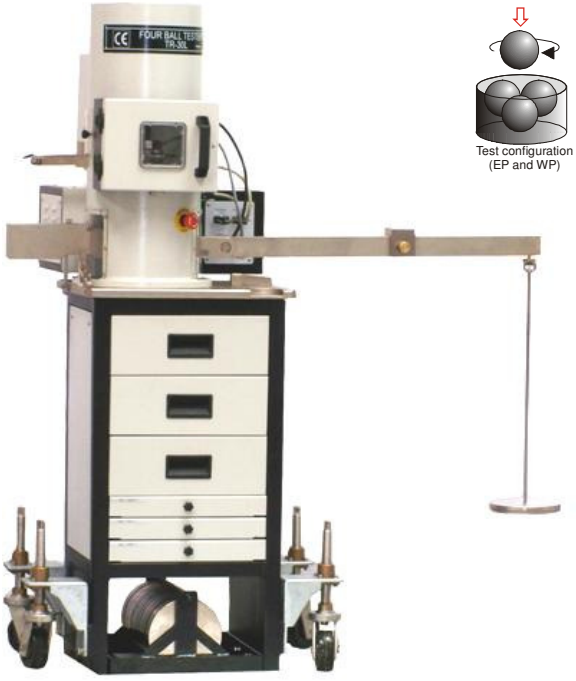
DUCOM's four ball tester TR-30 family is designed to determine wear preventive (WP), extreme pressure (EP), frictional, fatigue and shear stability behavior of lubricants. The machine consists of following sub assemblies:

- The mechanical tester consists of spindle assembly, motor, ball pot assembly, loading arrangement. There is a built-in accessory storage and ball tray to hold test balls.
- Sensors, Signal conditioning electronics.
- PC based machine control, data acquisition system and display.

OPERATION

A rotating steel ball is pressed against three steel balls firmly held together and immersed in lubricant under test. The test load, duration, temperature and rotational speed are set in accordance with standard test schedule. A unique device "Collate Master" makes it very easy to insert and remove test ball in collate.

In wear preventive tests average scar diameter on the surface of stationery balls is reported. It is the measure of wear preventive property of lubricant. A larger diameter indicates poor wear preventive property whilst a smaller indicates good. A measuring optical microscope is included to measure scar size. Scar of each ball is measured individually. Alternately, scar size on each ball can be measured with optional image acquisition system, while balls are still in the ball pot. Major, minor and average diameter of scar and scar area can be measured quickly and conveniently. Further, striation on the scar with different lubricants can be compared.



Ducom—TR 30 L machine with dead weight loading

In extreme pressure test the load is increased in specified steps after every run of the spindle till the load is arrived at which the lubrication at the contact fails resulting in welding of the balls. This load, at which welding occurs is the index of extreme pressure property of the lubricant. Welding causes a rapid increase in frictional torque. Machine stops when preset limit is exceeded.

In fatigue test under IP 300/82 can be performed with the Ducom four ball tester. The three lower balls are allowed to roll in a ball-cup with ground ball race. Rolling contact fatigue failure is indicated by increase in vibration which indicates end of the test. Peristaltic pump is a standard accessory of TR-30H which circulates cutting fluid in the ball pot during test. Vibration level at which tripping occurs can be set.

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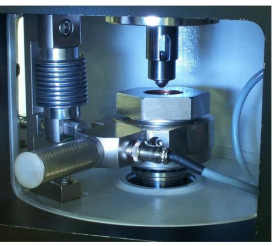


Four Ball Test Area

A tapered roller bearing holder arrangement is an optional accessory which facilitates working of oil for determination of shear stability in accordance with test method DIN 51350-06 – KRL/A. An electrical heater controls temperature of the bearing holder. In case it shoots up due to frictional heating, water from tap is let in for cooling. Test temperature of 60^0 C is maintained during the test. Test stops after preset number of revolutions.

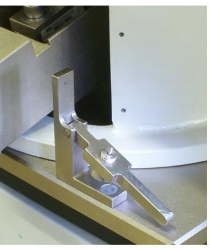
Standard method of loading is manual with sliding and dead weights. A load cell under ball pot facilitates setting of test load accurately. Pneumatic loading system is optional. A servo control loop ensures maintenance of desired value. It operates in two modes - manual and pre-programmed. In manual mode test load can be set to any desired value. In pre-programmed mode ASTM and IP standard loads are applied in specified sequence.

Sample Mounting Facilitator

INSTRUMENTATION

The TR-30 family of four ball testers is designed with instrumentation which permits measurement of actual load, RPM and temperature. Frictional torque during the test is measured. All these parameters are displayed during the test and data is acquired and displayed graphically on-line. Duration of the test is set by a digital preset timer.

The scar diameter is measured with a measuring microscope. An optional scar measuring microscope with image sensor permits acquiring of scar image on PC. It is possible to measure the size of the scar on PC screen with a variety of cursors.



Collet Master

Ducom—TR 30 L machine with dead weight loading

DATA ACQUISITION SYSTEM

PC acquires and displays on-line normal load, frictional force temperature and co-efficient of friction. Acquired data can be presented in several ways. Graphs of individual test can be printed. Results of different tests can be superimposed for comparative viewing. Data can be exported in ASCII format.

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Specifications

Parameter	Unit	TR 301	TR 30 L	TR 30 H	Remarks
Speed	RPM	1000 – 3000	1000 - 3000	1. 300 - 3000 2. 2000-10,000	1/ 1*
Max. Axial load	N	500	10,000	10,000	0.5/ 1*
Temperature	C	Ambient to 100	Ambient to 100	Ambient to 100	0.5/ 0.1*
Test ball (dia)	mm	12.7	12.7	12.7	
Scar range	Micron	100 - 4000	100 - 4000	100 - 4000	0.5 /10*
Drive motor	KW	0.75	1.5	1.5	
Power	V/Hz/VA	230/50/1/1000	380/50/3/2000	380/50/3/2000	Others on request

Features	Code	TR 301	TR 30 L	TR 30 H	Remarks
Wear preventive tests		✓	✓	✓	
Extreme pressure tests		×	✓	✓	
Friction		×	✓	✓	
High speed tests		×	×	✓	
Fatigue test	RFA	×	Optional	✓	
KRL shear stability test	KRL	×	Optional	Optional	
Pneumatic loading	PNU	×	Optional	Optional	
Image acquisition system	IAS	Optional	Optional	Optional	
Standards					
EP properties of lubricating fluids			ASTM D 2783	ASTM D 2783	
EP properties of lubricating grease			ASTM D 2596	ASTM D 2596	
WP properties of lubricating grease		ASTM D 2266	ASTM D 2266	ASTM D 2266	
WP properties of lubricating fluids		ASTM D 4172	ASTM D 4172	ASTM D 4172	
Coefficient of friction of lubricants		ASTM D 5183	ASTM D 5183	ASTM D 5183	
Viscosity shear stability of trasnmission lubricants			CEC L-45-T-93 (optional)	CEC L-45-T-93 (optional)	KRL option
Shear stability of polymer containing oils			DIN 51350-6 (optional)	DIN 51350-6 (optional)	KRL option
EP and AW properties of lubricants			IP 239	IP 239	
Rolling contact fatigue failure			IP 300 (optional)	IP 300	RFA option

- * Accuracy / Least count.
- Ordering Code Guide:
  Basic model code – option 1 – option 2 – option 3
  Example :TR-30L + KRL + PNU + IAS is a TR-30L with shear stability, pneumatic loading and image acquisition system options.
- Operating voltage other than specified on request.

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Test Ball Holding Tray

CALIBRATION

Equipment is supplied with a calibration certificate. The user can re-calibrate any time with the help of a calibration kit.

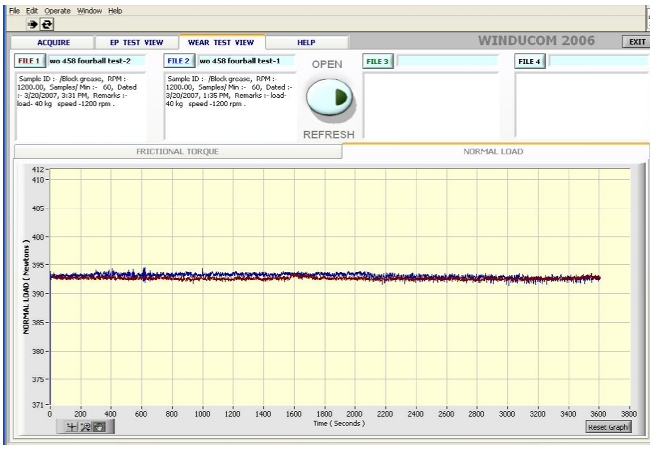
OPTIONAL

KRL Shear stability attachment with temperature controlled housing. (CEC-L-45-T-93)
(Water for cooling is required)

Pneumatic loading
(5 bar / 1 lpm pneumatic supply is required)

Image acquisition system.
(requires PC)

Ball Pot Assembly

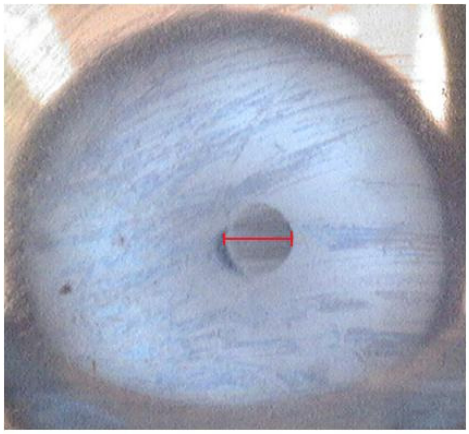


Sample software screen

Calibration Attachment

INCLUDED ACCESSORIES AND CONSUMABLES

• Measuring Microscope	1 No
• Ball pot assembly	2 Sets
• Steel balls	200 Nos.
• Collets	2 Nos.
• Collet master	1 No
• Torque wrench	1 No
• Calibration kit	1 No
• Operating manual	2 Nos.
• Tool kit	1 Set
• Peristaltic pump (with TR 30 H only)	1 No



Scar Image on Ducom Image Acquisition

Image Acquisition System

Note:
Ducom reserves the right to change specifications of its instruments without prior notice.
Images depict the general class of instrument. Actual instrument may vary.

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