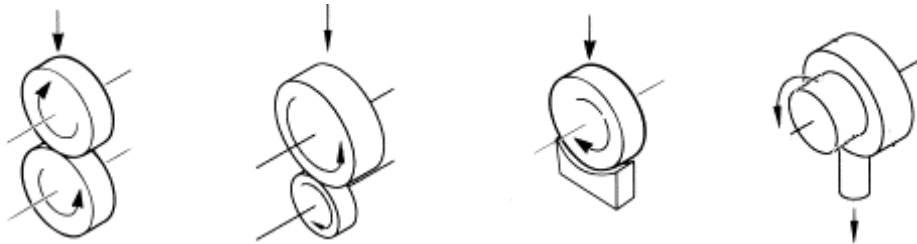


TE 74 TWO ROLLER MACHINE



General Description:

The TE 74 Two Roller Machine is a research machine for the study of wear and rolling contact fatigue of materials under conditions of pure rolling and rolling and sliding. The machine incorporates two motors, one to provide the input power and one to absorb the transmitted power.

To achieve satisfactory performance in line contact, the mounting/loading arrangement has adjustable alignment, with the upper specimen shaft carried on a pivoted arm and with a spherical bearing incorporated in the pivot axle. Axial alignment is achieved by indexing the pivot axle. Loading is achieved by means of a servo controlled pneumatic bellows actuator with force transducer feedback.

The lower specimen shaft is carried in fixed bearings. The drive to the lower roller incorporates an in-line torque transducer for measuring the input torque to the system. It should be noted that the traction measurement is thus subject to parasitic losses associated with the roller spindle bearings. These losses may be quantified by running the unit under conditions of zero slip at different speeds and temperatures.

A vibration sensor is provided for detecting rolling fatigue failure. The upper roller housing is electrically insulated and slip rings are provided on the roller shafts for electrical contact resistance measurement.

A lubricant service module is fitted as standard incorporating a sump tank with immersion heater, delivery pump, scavenge pump and oil to water heat exchangers for cooling.

The motors are a.c. and powered by conventional vector drives allowing precise control of speed. Power is re-circulated electrically via a common d.c. link between the drives, upstream of the frequency inverter stages. Total power requirement is thus limited to the system losses. For control purposes, one drive is designated as master with the second drive deriving its speed set point, adjusted for the required slip ratio, from the master drive.

Design Variants:

Two versions of the machine are available. The TE 74S (standard capacity) incorporates two 5.5 kW motors, a shaft centre distance of 40 mm and 12 kN loading system, whereas the TE 74H (high capacity) has two 30 kW motors, a shaft centre distance of 70 mm and 30 kN loading system.

Control and Data Acquisition:

The TE 74 has PC based sequence programmable control and data acquisition. This is provided by an integrated Serial Link Interface Module and [COMPEND 2000](#) software running on a host PC, operating under Windows. Data is stored to hard disc in standard spread sheet compatible file formats (.csv or .tsv).

Tests are defined by a sequence of steps, each step containing set-point, data recording rates and alarm level information. Set-points may be adjusted by step change or ramp. The test sequence is followed unless interrupted by the operator or an alarm. Set-points may also be adjusted manually using on screen toggles.

Controlled Parameters:

- Motor speed
- Motor speed difference
- Applied load
- Test fluid temperature
- Test duration

Measured Parameters

- Motor speed
- Motor speed difference
- Applied load
- Transmitted torque
- Lubricant inlet temperature
- Test bath outlet temperature
- Vibration sensor output
- Electrical contact resistance

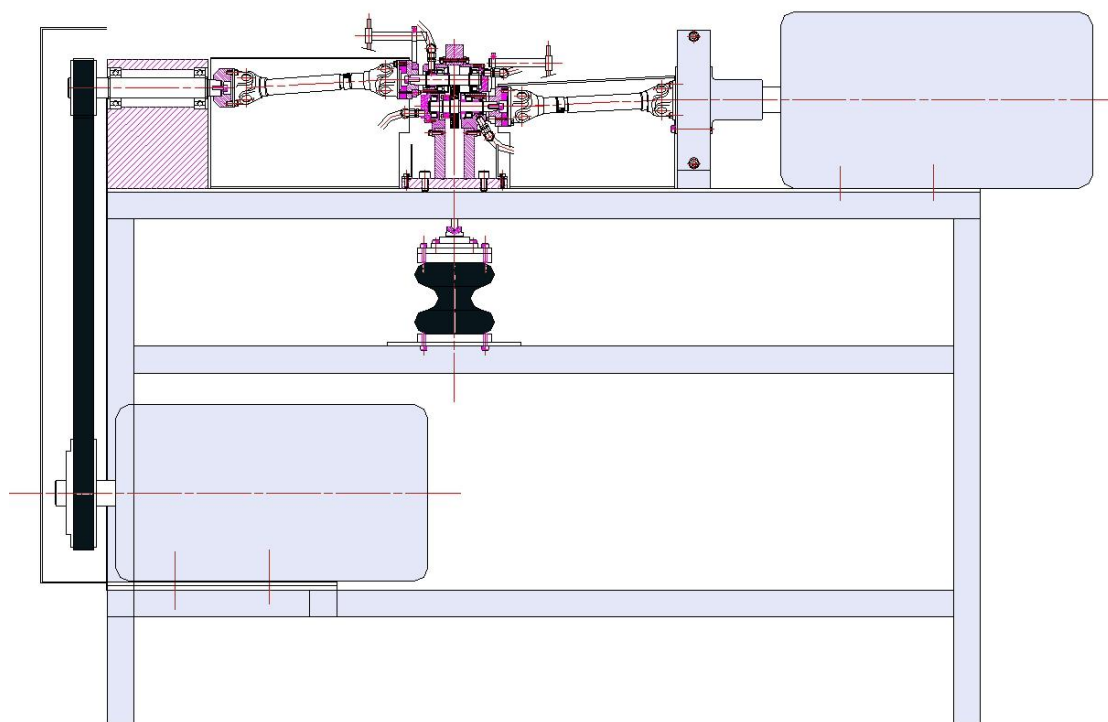
Technical Specification - General:

Test Conditions:	Pure Rolling Sliding/Rolling
Contact:	Line or point contact
Slide-Roll:	0 - 100 %
Temperature:	Ambient to 150°C

Configuration – TE 74S:

Lower roller motor direct coupled to lower shaft through in-line torque transducer and cardan shaft.

Upper roller connected to lay shaft by cardan shaft and lay shaft connected to upper roller motor by belt drive with ratios 1:1 and 1:2 (motor : shaft).



Technical Specification - TE 74S:

Shaft Centre Distance:	40	mm
Maximum Load:	12	kN

Lower Roller Motor:

Power:	5.5	kW
Base Speed:	1500	rpm
Maximum Torque at 1500 rpm:	35	Nm
Maximum Speed:	3000	rpm
Maximum Torque at 3000 rpm:	17.5	Nm

Drive Ratio: 1:1
 Maximum Speed Lower Roller: 3000 rpm

Upper Roller Motor:

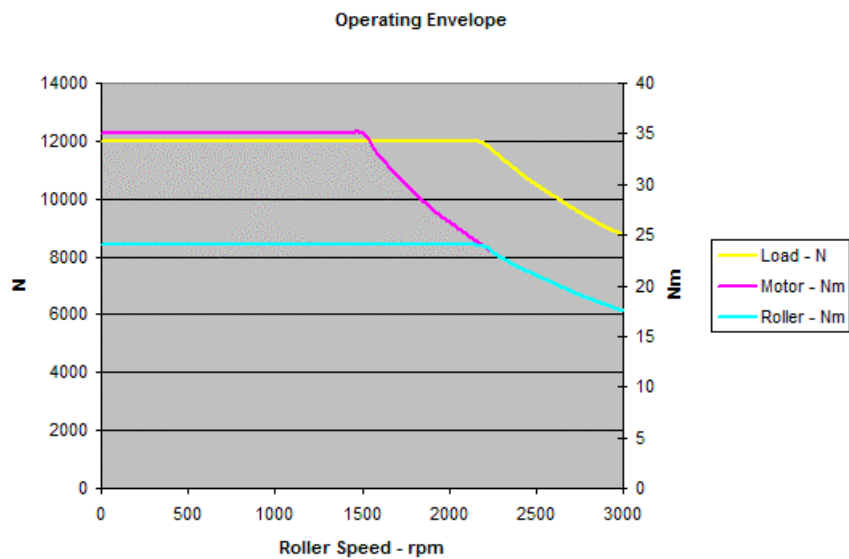
Power: 5.5 kW
 Base Speed: 1500 rpm
 Maximum Torque at 1500 rpm: 35 Nm
 Maximum Speed: 3000 rpm
 Maximum Torque at 3000 rpm: 17.5 Nm
 Drive Ratio: 1:1
 Maximum Speed Upper Roller: 3000 rpm
 Maximum Torque: 17.5 Nm
 Drive Ratio: 1:2
 Maximum Speed Upper Roller: 6000 rpm
 Maximum Torque: 8.75 Nm

Roller Diameters and Surface Speeds:

Lower Roller: 40 mm
 Maximum Surface Speed: 6.284 ms-1
 Upper Roller: 40 mm
 Maximum Surface Speed: 12.568 ms-1
 Maximum at Zero Slide/Roll Ratio: 6.284 ms-1

Lower Roller: 60 mm
 Maximum Surface Speed: 9.426 ms-1
 Upper Roller: 20 mm
 Maximum Surface Speed: 6.284 ms-1
 Maximum at Zero Slide/Roll Ratio: 6.284 ms-1

Operating Envelope – TE 74S:



Characteristic showing motor torque-speed characteristic (available torque) compared with roller generated torque, assuming traction coefficient of 0.1, with corresponding reduction in applied load. Note that the full load can be applied at full speed in pure rolling or under conditions where the traction coefficient is less than 0.07.

Assuming 40 mm diameter rollers and traction coefficient of 0.1, the maximum permissible load at maximum speed is 8.7 kN.

Flat Rollers		10 mm contact width				
	Lower Roller	Upper Roller	Load	Contact Width	Contact Pressure	Contact Length
	mm	mm	kN	mm	GPa	mm
Diameter	40	40	12	10	2.05	0.746
Diameter	65	15	12	10	2.62	0.582

Flat Rollers		5 mm contact width				
	Lower Roller	Upper Roller	Load	Contact Width	Contact Pressure	Contact Length
	mm	mm	kN	mm	GPa	mm
Diameter	40	40	12	5	2.90	1.055
Diameter	65	15	12	5	3.71	0.823

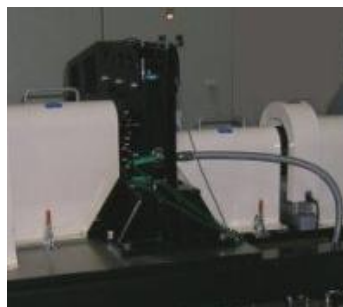
Crowned Rollers		4 GPa	Contact Pressure	Upper Roller	Load	Contact Diameter
	Lower Roller			mm	kN	mm
Diameter	40			40	2.74	1.145
Crown Radius	20			20		
Diameter	60			20	1.54	0.859
Crown Radius	30			10		

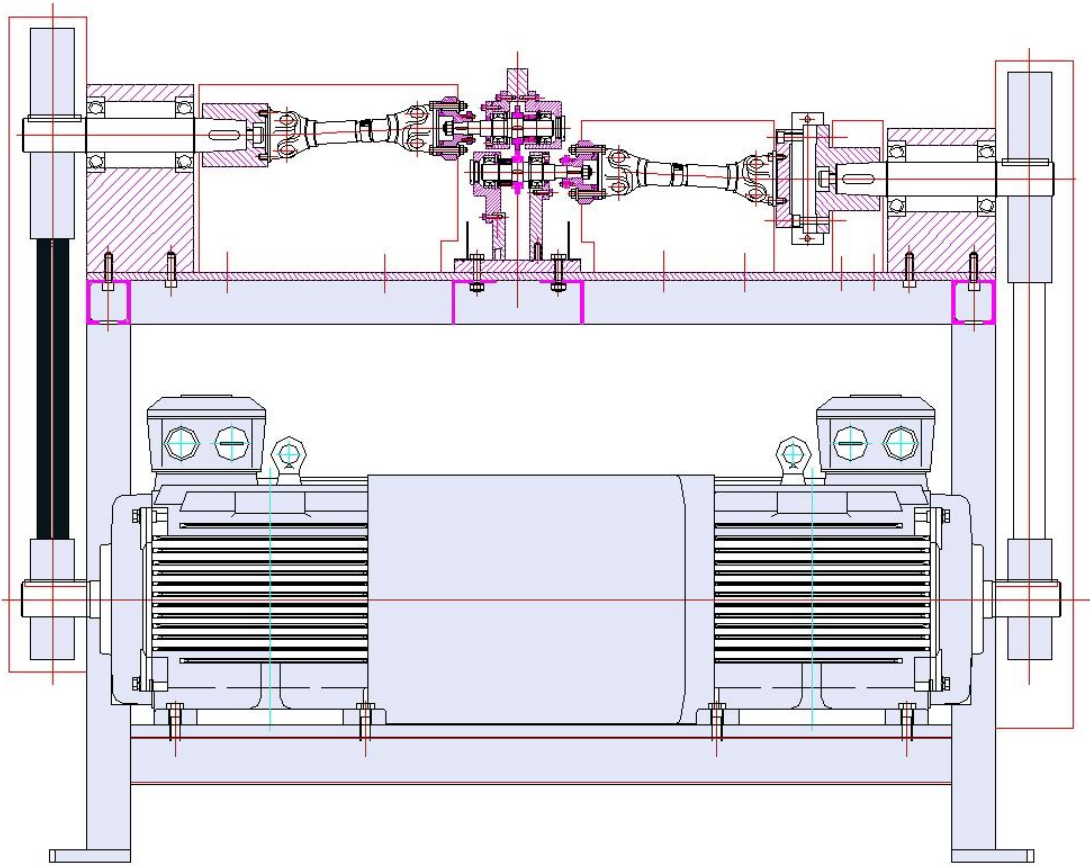
Note that as the minimum specimen diameter is 15 mm, a diameter of greater than this is required for a crowned roller sample machined on a 15 mm shaft. The practical minimum diameter for a crowned roller is thus 20 mm.

Configuration – TE 74H:

Lower roller connected to in-line torque transducer by cardan shaft, transducer connected to lay shaft by coupling and lay shaft connected to motor by belt drive with 1:1 ratio.

Upper roller connected to lay shaft by cardan shaft and lay shaft connected to upper roller motor by belt drive with ratios 1:1 and 1:2 (motor : shaft).





Technical Specification - TE 74H:

Shaft Centre Distance:	70	mm
Maximum Load:	30	kN

Lower Roller Motor:

Power:	30	kW
Base Speed:	1500	rpm
Maximum Torque at 1500 rpm:	190	Nm
Maximum Speed:	3000	rpm
Maximum Torque at 3000 rpm:	95	Nm
Drive Ratio:	1:1	
Maximum Speed Lower Roller:	3000	rpm

Upper Roller Motor:

Power:	30	kW
Base Speed:	1500	rpm
Maximum Torque at 1500 rpm:	190	Nm
Maximum Speed:	3000	rpm
Maximum Torque at 3000 rpm:	95	Nm
Drive Ratio:	1:1	
Maximum Speed Upper Roller:	3000	rpm

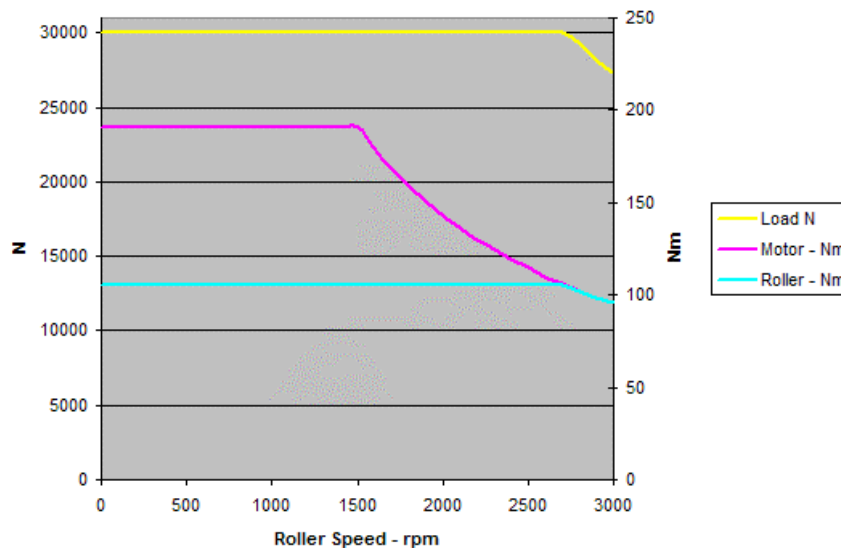
Maximum Torque:	95	Nm
Drive Ratio:	1:2	
Maximum Speed Upper Roller:	6000	rpm
Maximum Torque:	47.5	Nm

Roller Diameters and Surface Speeds:

Lower Roller:	70	mm
Maximum Surface Speed:	11	ms-1
Upper Roller:	70	mm
Maximum Surface Speed:	22	ms-1
Maximum at Zero Slide/Roll Ratio:	11	ms-1

Lower Roller:	110	mm
Maximum Surface Speed:	17.28	ms-1
Upper Roller:	30	mm
Maximum Surface Speed:	9.426	ms-1
Maximum at Zero Slide/Roll Ratio:	9.426	ms-1

Operating Envelope – TE 74H:



Characteristic showing motor torque-speed characteristic (available torque) compared with roller generated torque, assuming traction coefficient of 0.1, with corresponding reduction in applied load. Note that the full load can be applied at full speed in pure rolling or under conditions where the traction coefficient is less than 0.08.

Assuming 70 mm diameter rollers and traction coefficient of 0.1, the maximum permissible load at maximum speed is 27.3 kN.

Flat Rollers	10 mm contact width					
	Lower Roller	Upper Roller	Load	Contact Width	Contact Pressure	Contact Length
	mm	mm	kN	mm	GPa	mm
Diameter	70	70	30	10	2.44	1.56
Diameter	110	30	30	10	2.98	1.28

Flat Rollers	5 mm contact width					
	Lower Roller	Upper Roller	Load	Contact Width	Contact Pressure	Contact Length
	mm	mm	kN	mm	GPa	mm
Diameter	70	70	30	5	3.46	2.21
Diameter	110	30	30	5	4.22	1.81

Crowned Rollers	4 GPa Contact Pressure					
	Lower Roller	Upper Roller	Load	Contact Diameter		
	mm	mm	kN	mm		
Diameter	70	70	8.41	2.003		
Crown Radius	35	35				
Diameter	100	40	5.6	1.635		
Crown Radius	50	20				

Note that as the minimum specimen diameter is 30 mm, a diameter of greater than this is required for a crowned roller sample machined on a 30 mm shaft. The practical minimum diameter for a crowned roller is thus 40 mm.

Services:

Electricity TE 74S: 380/415V, three phase plus neutral, 50/60 Hz, 10 kW
 Electricity TE 74H: 380/415V, three phase plus neutral, 50/60 Hz, 40 kW
 Clean, dry air: 4 cfm at 8 bar (120 psi)
 Mains water and drain: 10 l/min (typical)

Order as:

TE 74S Two Roller Machine - Standard Capacity
 TE 74H Two Roller Machine - High Capacity