

Instrumented Micro Indentation Test

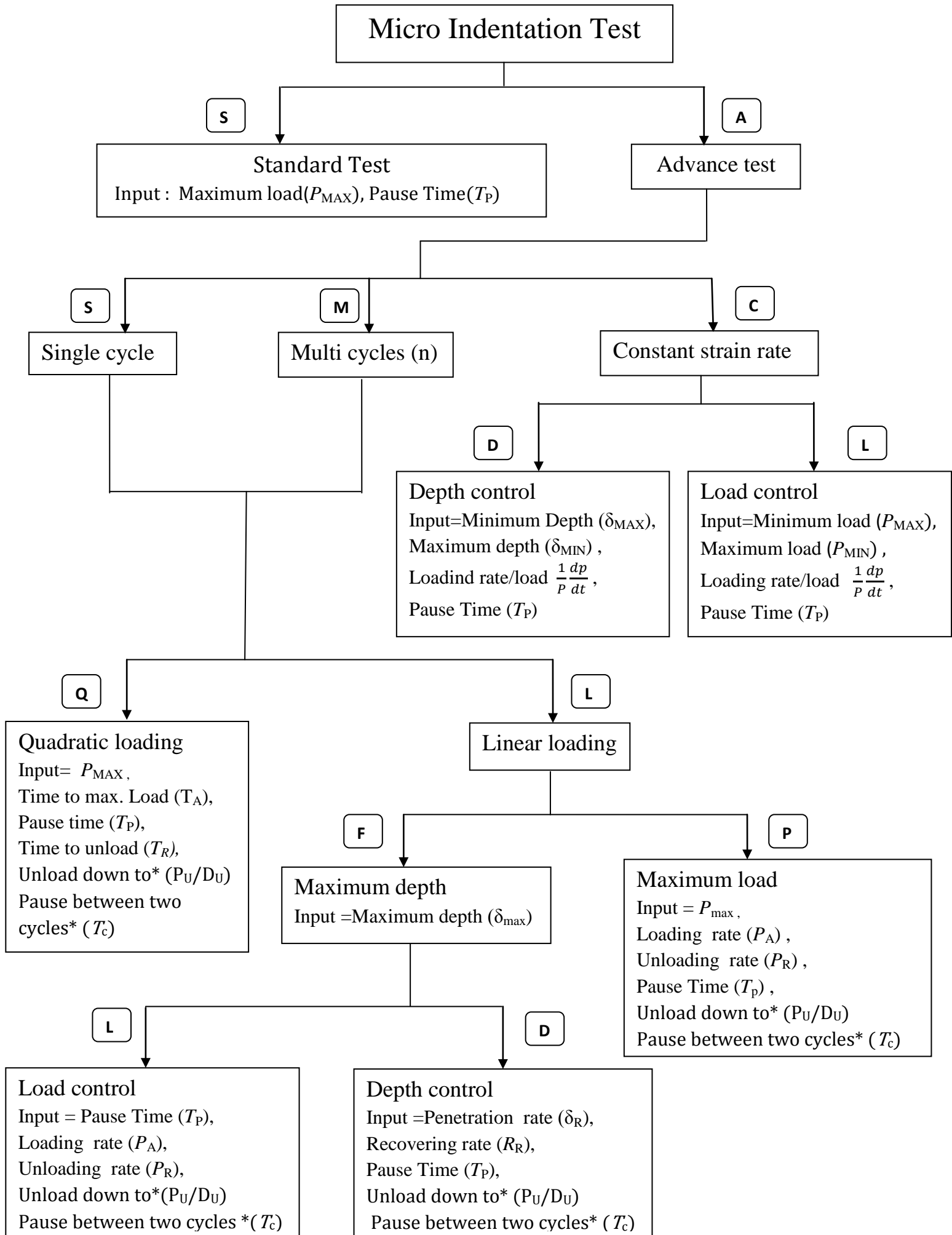
**Tribology Laboratory, Department of Mechanical Engineering
Indian Institute of Technology, Kharagpur, West Bengal-721302, India**

Capabilities and resolution of the instrument: Anton Paar Micro Combi Tester

Parameters	<i>Symbol</i>	Limiting Values
Maximum applied load	P_{MAX}	10 N
Load resolution	ΔP	0.1 mN
Maximum friction force	F_{MAX}	10 N
Friction force resolution	ΔF	0.1 mN
Maximum penetration depth	δ_{MAX}	100 micron
Penetration resolution	$\Delta \delta$	0.3 nm
Speed of table	V	0.1-600 mm/min
Maximum loading rate	P_A	1,00,000 mN/min
Maximum unloading rate	P_R	1,00,000 mN/min
Penetration rate	δ_A	5-1000 $\mu\text{m}/\text{min}$
Indenter recovery rate	δ_R	5-1000 $\mu\text{m}/\text{min}$
Maximum number of cycle	n	5000 cycles
Time to maximum load (quadratic loading)	T_A	500 sec
Time to unload (quadratic loading)	T_R	5000 sec
Loading rate/load (constant strain rate)	$\frac{1}{P} \frac{dp}{dt}$	500 1/sec
Maximum pause time	T_P	2 million sec
Maximum time between two cyclic load	T_C	7200 sec

Note: Working surface area of the Specimen should accommodate at least a circle of diameter 10 mm.

A software and associated result file will be provided to the user for further analysis



* This parameter is used in multi cycle test only to indicate at which load/depth cycle completes and next cycle starts

Test Parameter selection Table as per the Test Code

Test Code	P_{MAX}	P_{MIN}	δ_{MAX}	δ_{MIN}	T_P	n	$\frac{1}{P} \frac{dP}{dt}$	P_A	P_R	δ_R	R_R	T_A	T_R	$P_U/D_U/T_C$
S	✓				✓									
ASQ	✓				✓							✓	✓	
ASLFL			✓		✓			✓	✓					
ASLFD			✓		✓					✓	✓			
ASLP	✓				✓			✓	✓					
AMQ	✓				✓	✓						✓	✓	✓
AMLFL			✓		✓	✓		✓	✓					✓
AMLFD			✓		✓	✓				✓	✓			✓
AMLFP	✓				✓	✓		✓	✓					✓
ACD			✓	✓	✓		✓							
ACL	✓	✓			✓		✓							

Test codes need input as per the tick marks shown in the above Table

For example :

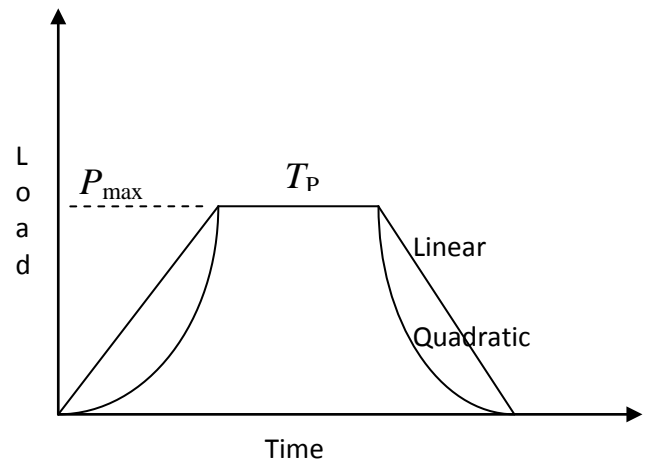
Test code: S (Standard/Default)

Input : Maximum load (P_{max})
 Pause time (T_P)

Test code: ASLFL (Advance Single cycle Linear loading for given maximum Depth at load control)

Input : Maximum Depth (δ_{max})
 Loading rate (P_A)
 Unloading rate (P_R)
 Pause Time (T_P)

Example of Loading profile



A software and associated result file will be provided to the user for further analysis

Instrumented Micro Indentation Testing (Work order)


Tribology Laboratory, Department of Mechanical Engineering, Indian Institute of Technology, Kharagpur

Fill the following	For office use only (sl. No.)
Submitted by (User): Roll No./EC.: Email: Phone: Department/Centre: Professor/Supervisor's Signature: Name: Test Code: No. of tests/samples: Date of Sample Submission:	<u>Test details</u> Expected Date of Results: Signature of Professor in-Charge (Tribology Laboratory) Signature of Head Deptt. of Mech. Engg.

Please Provide the Test Parameters

Test Code:_____

P_{MAX}	P_{MIN}	δ_{MAX}	δ_{MIN}	T_{P}	n	$\frac{1}{P} \frac{dP}{dt}$
P_{A}	P_{R}	δ_{R}	R_{R}	T_{A}	T_{R}	$P_{\text{U}}/D_{\text{U}}/T_{\text{C}}$

For office use only (sl. no. _____)	Instrumented Micro Indentation
Test Code: _____	
No. of tests/samples: _____	
Date of Sample Submission: _____	
Expected Date of Results: _____	Tribology Laboratory, MED, IIT Kharagpur
Signature of Professor in-Charge (Tribology Laboratory)	

Indian Institute of Technology Kharagpur

West Bengal – 721302

(Tribology Laboratory, Department of Mechanical Engineering, Indian Institute of Technology, Kharagpur)

Kindly allow me to conduct _____ no. of following tests with _____ no. of samples having approximate Vickers/Rockwell hardness no. _____

Type of tests	Put tick mark
Standard Micro Hardness	
Advanced Micro Hardness	

Signature of the User

Full name:

Department:

Roll No./E. Code.:

Telephone:

Signature of Professor/Supervisor

Full Name:

Department:

The Department/Centre/Section agrees to transfer of Rs. from its operating Grant to the Department of Mechanical Engineering operating Grant for the above work.

Signature of the
HOD/HOC/HOS (with Seal)

I agree to transfer Rs. from the project at SRIC (code: _____) to the Department of Mechanical Engineering account (DDF) at SRIC.

Signature of the PI (with Seal)

The total charge for the above work amounts to be Rs.

Signature of the
Laboratory-in-Charge
Tribology Laboratory
Department of Mechanical Engineering

Signature of Head
Department of Mechanical Engineering

Working charge per Test/Sample

Category (Type of Users)	Charge in INR	
	Standard Test	Advanced Test
Internal users (Department)	Nil	Nil
Internal users (Institute)	250	400