3300 Frame Specifications

Reference Manual - Equipment

Bluehill Help V 2.11 Revision A

The difference is measurable®

Electromagnetic Compatibility

Where applicable, this equipment is designed to comply with International Electromagnetic Compatibility (EMC) standards.

To ensure reproduction of this EMC performance, connect this equipment to a low impedance ground connection. Typical suitable connections are a ground spike or the steel frame of a building.

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General Safety Precautions

Materials testing systems are potentially hazardous.

Materials testing involves inherent hazards from high forces, rapid motions, and stored energy. You must be aware of all moving and operating components in the testing system that are potentially hazardous, particularly force actuators or a moving crosshead.

Carefully read all relevant manuals and observe all Warnings and Cautions. The term Warning is used where a hazard may lead to injury or death. The term Caution is used where a hazard may lead to damage to equipment or to loss of data.

Instron products, to the best of its knowledge, comply with various national and international safety standards, in as much as they apply to materials and structural testing. Our products are designed to the Instron Safety Standard (ICP-CS503), which is available on request. This standard is derived from various national and international standards including IEC61010-1. We certify that our products comply with all relevant EU directives (CE mark).

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At your request, we will gladly provide advice and quotations for additional safety devices such as protective shielding, warning signs or methods of restricting access to the equipment.

The following pages detail various general warnings that you must heed at all times while using materials testing equipment. You will find more specific Warnings and Cautions in the text whenever a potential hazard exists.

Your best safety precautions are to gain a thorough understanding of the equipment by reading your instruction manuals and to always use good judgement.

It is our strong recommendation that you should carry out your own safety risk assessment on the use of the test system, test methods employed, specimen loading and specimen behavior at failure.

Warnings

Crush Hazard - Allow only one person to handle or operate the system at all times.

Operator injury may result if more than one person operates the system. Before working inside the hazard area between the grips or fixtures, ensure that no other personnel can operate the computer or any of the system controls.

Crush Hazard - Take care when installing or removing a specimen, assembly, structure, or load string component.

Installation or removal of a specimen, assembly, structure, or load string component involves working inside the hazard area between the grips or fixtures. Keep clear of the jaws of a grip or fixture at all times. Keep clear of the hazard area between the grips or fixtures during actuator or crosshead movement. Ensure that all actuator or crosshead movements necessary for installation or removal are slow and, where possible, at a low force setting.

Hazard - Press the Emergency Stop button whenever you consider that an unsafe condition exists.

The Emergency Stop button removes hydraulic power or electrical drive from the testing system and brings the hazardous elements of the system to a stop as quickly as possible. It does not isolate the system from electrical power, other means are provided to disconnect the electrical supply. Whenever you consider that safety may be compromised, stop the test using the Emergency Stop button. Investigate and resolve the situation that caused the use of the Emergency Stop button before you reset it.

Flying Debris Hazard - Make sure that test specimens are installed correctly in grips or fixtures in order to eliminate stresses that can cause breakage of grip jaws or fixture components.

Incorrect installation of test specimens creates stresses in grip jaws or fixture components that can result in breakage of these components. The high energies involved can cause the broken parts to be projected forcefully some distance from the test area. Install specimens in the center of the grip jaws in line with the load path. Insert specimens into the jaws by at least the amount recommended in your grip documentation. This amount can vary between 66% to 100% insertion depth; refer to supplied instructions for your specific grips. Use any centering and alignment devices provided.

Hazard - Protect electrical cables from damage and inadvertent disconnection.

The loss of controlling and feedback signals that can result from a disconnected or damaged cable causes an open loop condition that may drive the actuator or crosshead rapidly to its extremes of motion. Protect all electrical cables, particularly transducer cables, from damage. Never route cables across the floor without protection, nor suspend cables overhead under excessive strain. Use padding to avoid chafing where cables are routed around corners or through wall openings.

Warnings

High/Low Temperature Hazard - Wear protective clothing when handling equipment at extremes of temperature.

Materials testing is often carried out at non-ambient temperatures using ovens, furnaces or cryogenic chambers. Extreme temperature means an operating temperature exceeding 60 °C (140 °F) or below 0 °C (32 °F). You must use protective clothing, such as gloves, when handling equipment at these temperatures. Display a warning notice concerning low or high temperature operation whenever temperature control equipment is in use. You should note that the hazard from extreme temperature can extend beyond the immediate area of the test.

Hazard - Do not place a testing system off-line from computer control without first ensuring that no actuator or crosshead movement will occur upon transfer to manual control.

The actuator or crosshead will immediately respond to manual control settings when the system is placed off-line from computer control. Before transferring to manual control, make sure that the control settings are such that unexpected actuator or crosshead movement cannot occur.

Robotic Motion Hazard - Keep clear of the operating envelope of a robotic device unless the device is de-activated.

The robot in an automated testing system presents a hazard because its movements are hard to predict. The robot can go instantly from a waiting state to high speed operation in several axes of motion. During system operation, keep away from the operating envelope of the robot. De-activate the robot before entering the envelope for any purpose, such as reloading the specimen magazine.

Hazard - Set the appropriate limits before performing loop tuning or running waveforms or tests.

Operational limits are included within your testing system to suspend motion or shut off the system when upper and/or lower bounds of actuator or crosshead travel, or force or strain, are reached during testing. Correct setting of operational limits by the operator, prior to testing, will reduce the risk of damage to test article and system and associated hazard to the operator.

Electrical Hazard - Disconnect the electrical power supply before removing the covers to electrical equipment.

Disconnect equipment from the electrical power supply before removing any electrical safety covers or replacing fuses. Do not reconnect the power source while the covers are removed. Refit covers as soon as possible.

Warnings

Rotating Machinery Hazard - Disconnect power supplies before removing the covers to rotating machinery.

Disconnect equipment from all power supplies before removing any cover which gives access to rotating machinery. Do not reconnect any power supply while the covers are removed unless you are specifically instructed to do so in the manual. If the equipment needs to be operated to perform maintenance tasks with the covers removed, ensure that all loose clothing, long hair, etc. is tied back. Refit covers as soon as possible.

Hazard - Shut down the hydraulic power supply and discharge hydraulic pressure before disconnection of any hydraulic fluid coupling.

Do not disconnect any hydraulic coupling without first shutting down the hydraulic power supply and discharging stored pressure to zero. Tie down or otherwise secure all pressurized hoses to prevent movement during system operation and to prevent the hose from whipping about in the event of a rupture.

Hazard - Shut off the supply of compressed gas and discharge residual gas pressure before you disconnect any compressed gas coupling.

Do not release gas connections without first disconnecting the gas supply and discharging any residual pressure to zero.

Explosion Hazard - Wear eye protection and use protective shields or screens whenever any possibility exists of a hazard from the failure of a specimen, assembly or structure under test.

Wear eye protection and use protective shields or screens whenever a risk of injury to operators and observers exists from the failure of a test specimen, assembly or structure, particularly where explosive disintegration may occur. Due to the wide range of specimen materials, assemblies or structures that may be tested, any hazard resulting from the failure of a test specimen, assembly or structure is entirely the responsibility of the owner and the user of the equipment.

Hazard - Ensure components of the load string are correctly pre-loaded to minimize the risk of fatigue failure.

Dynamic systems, especially where load reversals through zero are occurring, are at risk of fatigue cracks developing if components of the load string are not correctly pre-loaded to one another. Apply the specified torque to all load string fasteners and the correct setting to wedge washers or spiral washers. Visually inspect highly stressed components such as grips and threaded adapters prior to every fatigue test for signs of wear or fatigue damage.

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Chapter 1
3340 Series specifications

The 3340 Series of universal materials testing systems offer a variety of frames that range in size and capacity. The following topics summarize the specifications for the 3342, 3343, 3344 and 3345 single column table models.

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System performance for 3340 Series

Table 1-1. Series 3340 system performance

Series 3340 system performance					
Parameter	**Specifications**				
	3342	**3343**	**3344**	**3345**	**3345 Extra Height**
Testing type	Tension, compression, and through zero operation. Frames are also capable of limited cyclic testing as outlined in "Cyclic testing for 3340 Series" on page 1-5. Standard configuration is below the moving crosshead.				
Basic control mode	Closed loop position control.				
Load capacity kN kgf lbf	0.5 50 110	1 100 225	2 200 450	5 510 1125	5 510 1125

Table 1-1. Series 3340 system performance (Continued)

Series 3340 system performance					
Parameter	**Specifications**				
	3342	**3343**	**3344**	**3345**	**3345 Extra Height**
Maximum speed mm/min in/min	1000 40				
Minimum speed mm/min in/min	0.05 0.002				
Maximum force at full speed kN kgf lbf	0.5 50 110	1 100 225	2 200 450	5 510 1125	5 510 1125
Maximum speed at full load mm/min in/min	1000 40				
Return speed mm/min in/min	1500 60			1200 48	
Crosshead speed accuracy	± 0.2% at steady state and no load				
Position accuracy (Extension)	Under no load conditions, equal or less than ± 0.02 mm (0.0008 in) or ± 0.05% of displayed reading, whichever is greater.				
Position repeatability	± 0.015 mm (0.0006 in)				
Load measurement accuracy	± 0.5% of reading down to 1/100 of load cell capacity when using 2519 series load cells at 25° C (77° F).				
Strain measurement accuracy	± 0.5% of reading down to 1/50 of full scale with ASTM E83 class B or ISO 9513 class 0.5 extensometer.				
Crosshead position control resolution	0.156 µm	0.156 µm	0.208 µm	0.133 µm	0.133 µm
Acceleration time, 0 to top speed	60 ms			70 ms	
Emergency stop time	100 ms				

Extension accuracy for 3340 Series

When measuring strain on a specimen, it can be measured using either the frame's extension readout or an extensometer directly on the specimen. Deciding which method to use depends on the required accuracy and careful evaluation of the errors introduced from system compliance (deflection under load) as compared to the compliance of the gauge section on the specimen. Note that the position (i.e. extension) accuracy given in the system performance tables assumes a no-load condition, so the error from system compliance must be added to this value. Since extension is measured by an encoder installed on the motor shaft, it cannot compensate for the compliance of the crosshead, load cell, grips and other system components that are in the load path between the motor and the specimen.

Over short travels and higher loads, the error resulting from system compliance can be over 100%. Conversely, over longer travels and lower loads, the error may be insignificant. The frame compliance and deflection at full load values shown in the following table may be used to assess this effect, and determine whether extension can accurately measure strain for your test scenario. If extension cannot measure strain under your test scenario, it is recommended that you use an extensometer. In general, the extension readout should not be used as the primary strain measuring device in situations where your testing requirements warrant using an extensometer on the specimen.

Table 1-2. Series 3340 frame compliance

Series 3340 frame compliance			
Model	**Frame compliance**	**Deflection at full load (Frame only)**	**Mean stiffness[a]**
3342	0.50 mm/kN 88 µin/lb	0.25 mm 0.010 in	2 kN/mm 11400 lb/in
3343	0.50 mm/kN 88 µin/lb	0.50 mm 0.020 in	2 kN/mm 11400 lb/in
3344	0.50 mm/kN 88 µin/lb	1.00 mm 0.039 in	2 kN/mm 11400 lb/in
3345	0.12 mm/kN 21 µin/lb	0.59 mm 0.023 in	8.5 kN/mm 48500 lb/in
3345 Extra height	0.12 mm/kN 21 µin/lb	0.59 mm 0.023 in	8.5 kN/mm 48500 lb/in

a. The frame and drive (excluding load cell or grip string) is measured with the top of the crosshead at the travel midpoint. Values represent the extension that would be indicated on the display if the frame was loaded with an “infinitely stiff” load string and specimen. The stiffness values can vary ±10% from the mean.

Operating envelope for 3340 Series

The operating envelope is the boundary within which tests must be performed. Look at the Maximum force at full speed and Maximum speed at full force parameters for your model in “System Performance”.

Within the operating envelope there can be two zones:

- Continuous operation zone - When the maximum load and speed parameters of the test fall within this zone, the frame may run continuously (including long term low speed or zero speed tests), and it does not require a waiting period between tests. You may start the next test as soon as the current test finishes. However, cyclic testing, in which the frame constantly reverses direction, is limited as outlined in “Cyclic Testing”.
- Intermittent operation zone (50% duty zone) - When the maximum load and speed parameters of your test fall within this zone, then the idle time between tests must be equal to or more than the test duration time. This allows time between tests for the motor and power amplifier to cool. For example, if a test runs into the 50% duty zone and lasts for 5 minutes, then you must wait 5 minutes or more before starting another test.

Refer to the following figure to determine the operating envelope zone for 3342, 3343, 3344 and 3345 models.

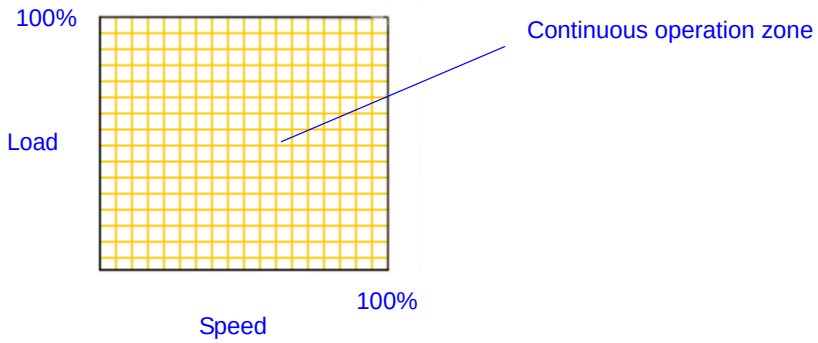

Figure 1-1. Operating envelope for Series 3340 models

Cyclic testing for 3340 Series

This section describes the cyclic frequency limitations for the 3342, 3343, 3344 and 3345 models.

Cyclic testing is defined as tests where the cycling limits are enabled and testing requires that the frame constantly reverses direction. Cyclic testing on electromechanical load frames is limited by the heating of the power amplifier. If the power amplifier is close to overheating, a thermal protection switch activates and automatically shuts down the amplifier.

To ensure that the power amplifier stays within its heating limits, cyclic testing must stay within the limits summarized in the following table.

In addition to the speed and cyclic frequency limits shown in this table, you must also consider the operating envelope for the system. Refer to “Operating Envelope” to determine the boundary limits of the system and if a 50% duty cycle requirement applies to your testing parameters.

Caution

Electromechanical load frames are not suitable for fatigue testing. The values shown in the following table are for guidance only and assume an elastic specimen and an ambient temperature of 25° C (77° F). Higher ambient temperatures may further limit the performance.

Table 1-3. Series 3340 - Continuous cyclic testing limits

Series 3340 - Continuous cyclic testing limits	
Parameter	**Series 3340 models**
Maximum speed	Must not exceed 50% of the frame’s rated speed (refer to “System performance for 3340 Series” on page 1-1)
Total cyclic period	Greater than 1 second
Cyclic frequency	Less than 1 Hz

All cyclic testing has a 50% duty requirement. The idle time between cyclic tests must be equal to or more than the test duration time. This allows time between tests for the motor and power amplifier to cool. For example, if a test lasts for 5 minutes, you must wait 5 minutes or more before starting another test.

Chapter 2
3360 Series specifications

The 3360 Series of universal materials testing systems offer a variety of frames that range in size and capacity. The following topics summarize the specifications for the 3365, 3366, 3367 and 3369 dual column table models.

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System performance for 3360 Series

Table 2-1. Series 3360 system performance

Series 3360 system performance				
Parameter	**Specifications**			
	3365	**3366**	**3367**	**3369**
Testing type	Tension, compression, and through zero operation. Frames are also capable of limited cyclic testing as outlined in "Cyclic testing for 3360 Series" on page 2-6. Standard configuration is below the moving crosshead.			
Basic control mode	Closed loop position control.			
Load capacity kN kgf lbf	5 500 1125	10 1000 2250	30 3000 6750	50 5000 11240

Table 2-1. Series 3360 system performance (Continued)

Series 3360 system performance				
Parameter	**Specifications**			
	3365	**3366**	**3367**	**3369**
Maximum speed mm/min in/min	 1000 40	 500 20	 500 20	 500 20
Minimum speed mm/min in/min	 0.01 0.0004	 0.005 0.0002	 0.005 0.0002	 0.005 0.0002
Maximum force at full speed [a] kN kgf lbf	 5 500 1125	 10 1000 2250	 15 1530 3375	 25 2500 5620
Maximum speed at full load [1] mm/min in/min	 1000 40	 500 20	 250 10	 250 10
Return speed mm/min in/min	 1200 48	 600 24	 600 24	 500 20
Crosshead speed accuracy	± 0.2% at steady state and no load			
Position accuracy (Extension)	Under no load conditions, equal to or less than ± 0.02 mm (0.0008 in) or ± 0.05% of displayed reading, whichever is greater.			
Position repeatability	± 0.015 mm (0.0006 in)			
Load measurement accuracy	± 0.5% of reading down to 1/100 of load cell capacity when using 2530 series load cells at 25° C (77° F).			
Strain measurement accuracy	± 0.5% of reading down to 1/50 of full scale with ASTM E83 class B or ISO 9513 class 0.5 extensometer.			
Crosshead position control resolution	0.118 µm (4 µ in)	0.057 µm (2 µ in)	0.054 µm (2 µ in)	0.0625 µm (2.5 µ in)
Acceleration time, 0 to top speed	150 ms			
Emergency stop time	100 ms	100 ms	300 ms	320 ms

a. Refer to “Operating envelope for 3360 Series” on page 2-4 for more details.

Extension accuracy for 3360 Series

When measuring strain on a specimen, it can be measured using either the frame's extension readout or an extensometer directly on the specimen. Deciding which method to use depends on the required accuracy and careful evaluation of the errors introduced from system compliance (deflection under load) as compared to the compliance of the gauge section on the specimen. Note that the position (i.e. extension) accuracy given in the system performance tables assumes a no-load condition, so the error from system compliance must be added to this value. Since extension is measured by an encoder installed on the motor shaft, it cannot compensate for the compliance of the crosshead, load cell, grips and other system components that are in the load path between the motor and the specimen.

Over short travels and higher loads, the error resulting from system compliance can be over 100%. Conversely, over longer travels and lower loads, the error may be insignificant. The frame compliance and deflection at full load values shown in the following table may be used to assess this effect, and determine whether extension can accurately measure strain for your test scenario. If extension cannot measure strain under your test scenario, it is recommended that you use an extensometer. In general, the extension readout should not be used as the primary strain measuring device in situations where your testing requirements warrant using an extensometer on the specimen.

Table 2-2. Series 3360 frame compliance

Series 3360 frame compliance			
Model	**Frame compliance**	**Deflection at full load (Frame only)**	**Mean stiffness[a]**
3365/3365EH	0.026 mm/kN 4.6 µin/lb	0.13 mm 0.005 in	38 kN/mm 217000 lb/in
3366/3366EH	0.026 mm/kN 4.6 µin/lb	0.26 mm 0.010 in	38 kN/mm 217000 lb/in
3367/3367EH	0.014 mm/kN 2.4 µin/lb	0.42 mm 0.016 in	72 kN/mm 411000 lb/in
3369/3369EH	0.012 mm/kN 2.1 µin/lb	0.61 mm 0.024 in	82 kN/mm 468000 lb/in

a. The frame and drive (excluding load cell or grip string) is measured with the top of the crosshead at the travel midpoint. Values represent the extension that would be indicated on the display if the frame was loaded with an “infinitely stiff” load string and specimen. The stiffness values can vary ±10% from the mean.

Operating envelope for 3360 Series

This section describes the cyclic frequency limitations for the 3365, 3366, 3367 and 3369 models.

The operating envelope is the boundary within which tests must be performed. Look at the Maximum force at full speed and Maximum speed at full force parameters for your model in “System Performance”.

Within the operating envelope there can be two zones:

- Continuous operation zone - When the maximum load and speed parameters of the test fall within this zone, the frame may run continuously (including long term low speed or zero speed tests), and it does not require a waiting period between tests. You may start the next test as soon as the current test finishes. However, cyclic testing, in which the frame constantly reverses direction, is limited as outlined in “Cyclic Testing”.
- Intermittent operation zone (50% duty zone) - When the maximum load and speed parameters of your test fall within this zone, then the idle time between tests must be equal to or more than the test duration time. This allows time between tests for the motor and power amplifier to cool. For example, if a test runs into the 50% duty zone and lasts for 5 minutes, then you must wait 5 minutes or more before starting another test.

Refer to the following figures to determine the operating envelope zones for 3365, 3366, 3367 and 3369 models.

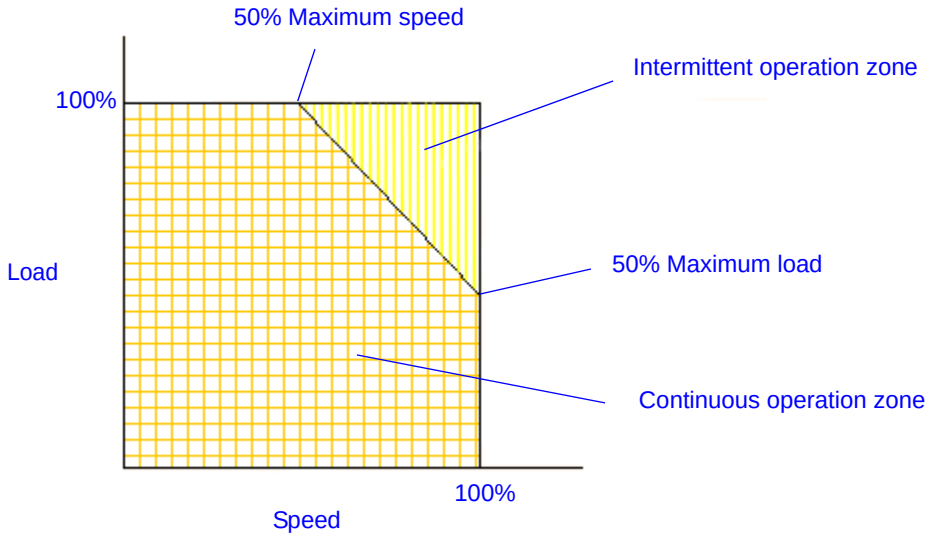

Figure 2-1. Operating envelope for 3365 and 3366 models

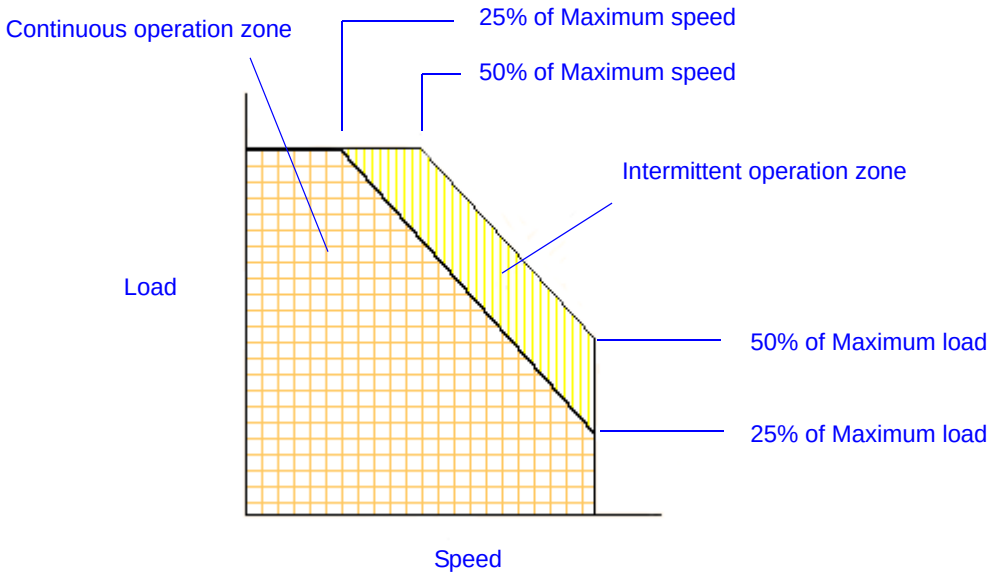

Figure 2-2. Operating envelope for 3367 and 3369 models

Cyclic testing for 3360 Series

This section describes the cyclic frequency limitations for the 3365, 3366, 3367 and 3369 models.

Cyclic testing is defined as tests where the cycling limits are enabled and testing requires that the frame constantly reverses direction. Cyclic testing on electromechanical load frames is limited by the heating of the power amplifier. If the power amplifier is close to overheating, a thermal protection switch activates and automatically shuts down the amplifier.

To ensure that the power amplifier stays within its heating limits, cyclic testing must stay within the limits summarized in the following table.

In addition to the speed and cyclic frequency limits shown in this table, you must also consider the operating envelope for the system. Refer to “Operating Envelope” to determine the boundary limits of the system and if a 50% duty cycle requirement applies to your testing parameters.

Caution

Electromechanical load frames are not suitable for fatigue testing. The values shown in the following table are for guidance only and assume an elastic specimen and an ambient temperature of 25° C (77° F). Higher ambient temperatures may further limit the performance.

Table 2-3. Series 3360 - Continuous cyclic testing limits

Series 3360 - Continuous cyclic testing limits	
Parameter	**Series 3360 Models**
Maximum speed	Must not exceed 50% of the frame’s rated speed (refer to “System performance for 3360 Series” on page 2-1)
Total cyclic period	Greater than 4 seconds
Cyclic frequency	Less than 0.25 Hz

All cyclic testing has a 50% duty requirement. The idle time between cyclic tests must be equal to or more than the test duration time. This allows time between tests for the motor and power amplifier to cool. For example, if a test lasts for 5 minutes, you must wait 5 minutes or more before starting another test.

Chapter 3
3380 Series specifications

The 3380 Series of universal materials testing systems offer a variety of frames that range in size and capacity. The following topics summarize the specifications for the 3382, 3384 and 3385H floor models.

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System performance for 3380 Series

Table 3-1. Series 3380 system performance

Series 3380 system performance			
Parameter	**Specifications**		
	3382	**3384**	**3385H**
Testing types	Tension, Compression and through zero operation. Standard configuration is below the moving crosshead. Not suitable for fatigue testing, but limited cyclic testing is available. Refer to "Cyclic testing for 3380 Series" on page 3-6. High frequency waveforms are subject to mechanical limitations of the load frame and may cause excessive wear on the load frame.		
Basic control mode	Closed loop position control.		
Load capacity kN kgf lbf	 100 10000 22500	 150 15000 33750	 250 25000 56200

Table 3-1. Series 3380 system performance (Continued)

Series 3380 system performance			
Parameter	**Specifications**		
	3382	**3384**	**3385H**
Maximum speed mm/min in/min	500 20		
Minimum speed mm/min in/min	0.005 0.0002		
Maximum force at full speed kN kgf lbf	50 5100 11240	75 7650 16850	100 10200 22500
Maximum speed at full load mm/min in/min	250 10	250 10	200 8
Return speed mm/min in/min	600 24	600 24	500 20
Crosshead speed accuracy	±0.2% of set speed at steady state, no load.		
Position accuracy (Extension)	Under no load conditions, equal to or less than ±0.02 mm (0.0008 in) or ±0.05% of displayed reading, whichever is greater.		
Position repeatability	±0.015 mm (0.0006 in)		
Load measurement accuracy	±1.0% of reading down to 1/100 of load cell capacity.		
Strain measurement accuracy	±0.5% of reading down to 1/50 of full scale with ASTM E83 class B or ISO 9513 class 0.5 extensometer.		
Crosshead position control resolution	0.0598 µm	0.0133µm	0.0598 µm
Acceleration time, 0 to top speed	660 ms	340 ms	685 ms
Emergency stop time	400 ms	300 ms	650 ms

Extension accuracy for 3380 Series

When measuring strain on a specimen, it can be measured using either the frame's extension readout or an extensometer directly on the specimen. Deciding which method to use depends on the required accuracy and careful evaluation of the errors introduced from system compliance (deflection under load) as compared to the compliance of the gauge section on the specimen. Note that the position (i.e. extension) accuracy given in the system performance tables assumes a no-load condition, so the error from system compliance must be added to this value. Since extension is measured by an encoder installed on the motor shaft, it cannot compensate for the compliance of the crosshead, load cell, grips and other system components that are in the load path between the motor and the specimen.

Over short travels and higher loads, the error resulting from system compliance can be over 100%. Conversely, over longer travels and lower loads, the error may be insignificant. The frame compliance and deflection at full load values shown in the following table may be used to assess this effect, and determine whether extension can accurately measure strain for your test scenario. If extension cannot measure strain under your test scenario, it is recommended that you use an extensometer. In general, the extension readout should not be used as the primary strain measuring device in situations where your testing requirements warrant using an extensometer on the specimen.

Table 3-2. Series 3380 frame compliance

Series 3380 frame compliance			
Model	**Frame compliance**	**Deflection at full load (Frame only)**	**Mean stiffness[a]**
3382	0.0042 mm/kN 0.7 µin/lb	0.42 mm 0.017 in	236 kN/mm 1.35 x 10^6 lb/in
3384	0.0048 mm/kN 0.8 µin/lb	0.71 mm 0.028 in	210 kN/mm 1.20 x 10^6 lb/in
3385H	0.0032 mm/kN 0.6 µin/lb	0.81 mm 0.032 in	310 kN/mm 1.77 x 10^6 lb/in

a. The frame and drive (excluding load cell or grip string) is measured with the top of the crosshead at the travel midpoint. Values represent the extension that would be indicated on the display if the frame was loaded with an “infinitely stiff” load string and specimen. The stiffness values can vary ±10% from the mean.

Operating envelope for 3380 Series

This section describes the cyclic frequency limitations for the 3382, 3384 and 3385H models.

The operating envelope is the boundary within which tests must be performed. Look at the Maximum force at full speed and Maximum speed at full force parameters for your model in “System Performance”.

Within the operating envelope there can be two zones:

- Continuous operation zone - When the maximum load and speed parameters of the test fall within this zone, the frame may run continuously (including long term low speed or zero speed tests), and it does not require a waiting period between tests. You may start the next test as soon as the current test finishes. However, cyclic testing, in which the frame constantly reverses direction, is limited as outlined in “Cyclic Testing”.
- Intermittent operation zone (50% duty zone) - When the maximum load and speed parameters of your test fall within this zone, then the idle time between tests must be equal to or more than the test duration time. This allows time between tests for the motor and power amplifier to cool. For example, if a test runs into the 50% duty zone and lasts for 5 minutes, then you must wait 5 minutes or more before starting another test.

Refer to the following figures to determine the operating envelope zones for 3382, 3384 and 3385H models.

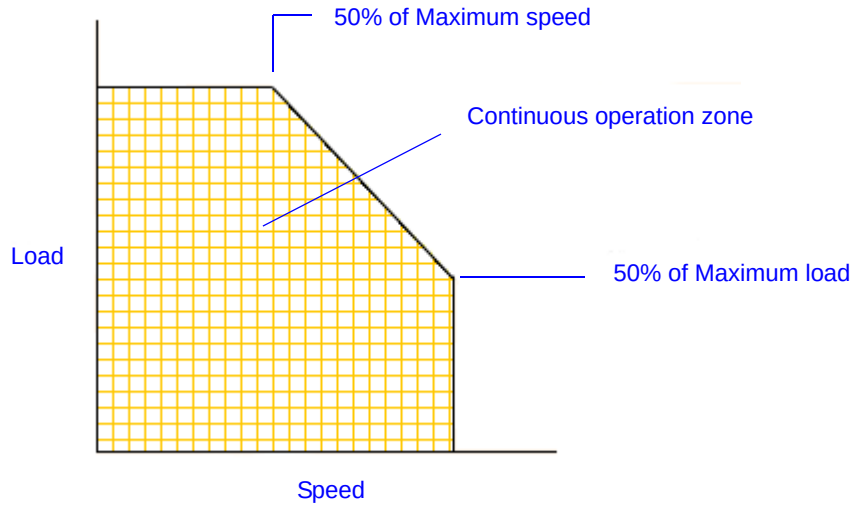

Figure 3-1. Operating envelope for 3382 and 3384 models

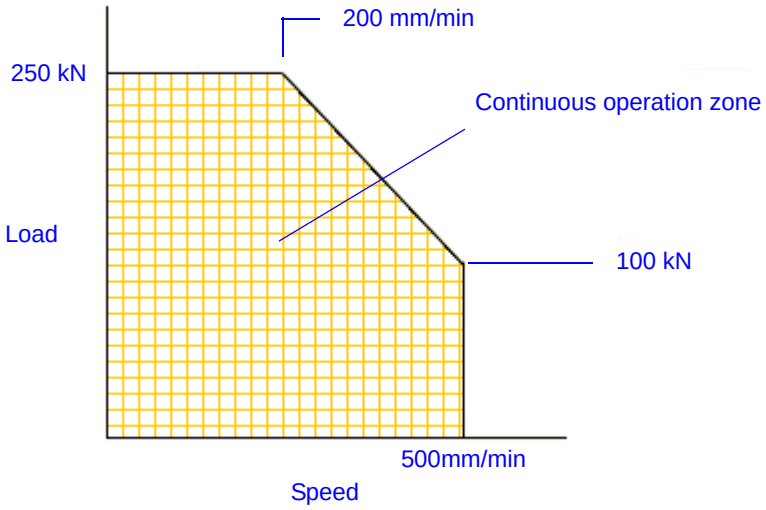

Figure 3-2. Operating envelope for 3385H model

Cyclic testing for 3380 Series

This section describes the cyclic frequency limitations for the 3382, 3384 and 3385H models.

Cyclic testing is defined as tests where the cycling limits are enabled and testing requires that the frame constantly reverses direction. Cyclic testing on electromechanical load frames is limited by the heating of the power amplifier. If the power amplifier is close to overheating, a thermal protection switch activates and automatically shuts down the amplifier.

To ensure that the power amplifier stays within its heating limits, cyclic testing must stay within the limits summarized in the following table.

In addition to the speed and cyclic frequency limits shown in this table, you must also consider the operating envelope for the system. Refer to “Operating Envelope” to determine the boundary limits of the system and if a 50% duty cycle requirement applies to your testing parameters.

Caution

Electromechanical load frames are not suitable for fatigue testing. The values shown in the following table are for guidance only and assume an elastic specimen and an ambient temperature of 25° C (77° F). Higher ambient temperatures may further limit the performance.

Table 3-3. Series 3380 - Continuous cyclic testing limits

Series 3380 - Continuous cyclic testing limits	
Parameter	**Series 3380 Models**
Maximum speed	Must not exceed 50% of the frame’s rated speed (refer to “System performance for 3380 Series” on page 3-1)
Total cyclic period	Greater than 5 seconds
Cyclic frequency	Less than 0.20 Hz

All cyclic testing has a 50% duty requirement. The idle time between cyclic tests must be equal to or more than the test duration time. This allows time between tests for the motor and power amplifier to cool. For example, if a test lasts for 5 minutes, you must wait 5 minutes or more before starting another test.

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