CPC
Quality Card
Data Analysis System
Users Manual

Doc# 75587C

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(Manual and features based on CPC Version 2018.3.20)

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Revision log

This chapter lists the revisions made to the manual:

- Nov 12, 2016 - Original
    - New manual created for Quality Card system.
- Jan 23, 2017 – Revision A
    - Page 17 - Revised Disregard Part TC section to use tag names rather than numbers.
    - Page 38 – separated Other Settings into individual sections. Also expanded on Min Part TC Qty analysis.
- April 26, 2017 – Revision B
    - Page 18 – Added a new function to Disregard TC for entire run if the TC is disabled at any time during the run.
- Mar 20, 2018 – Revision C
    - Modified per CPC update 2018.3.20
    - Page 37 – changed image of temperature section
    - Page 38 – added “Allow rates to calculate from data before phase or range” option.
    - Page 50 – added MaxPartTemp, nd MinPartTemp to variables
    - Page 51 – AfterLast script was added.

General Information

This manual provides procedures and documentation to explain the capabilities of the quality data analysis system provided within the CPC software package.

Who should use this manual?

This document should be used by the following personnel:

- Anyone who wants to create and/or edit Quality Cards
- Process engineers who wish to understand the CPC data-analysis system
- Quality inspectors who wish to understand the CPC quality system and quality cards

What is “Quality Analysis”?

Quality analysis is the procedure of analyzing cure cycle data and determining the quality of the processed part(s) by comparing that data to a predefined set of criteria and tolerances. Once analyzed, the system will output to a report the findings of the analysis so that an operator, engineer, or quality representative can quickly evaluate whether the run has met specification.

What is a quality card?

The CPC software has a powerful functionality that performs automatic analysis and reporting of data by comparing the saved run data to pre-configured criteria stored on a “quality cards”.

Quality cards are designed and configured by an engineer or quality inspector, and are used by the system to generate quality and exception reports.

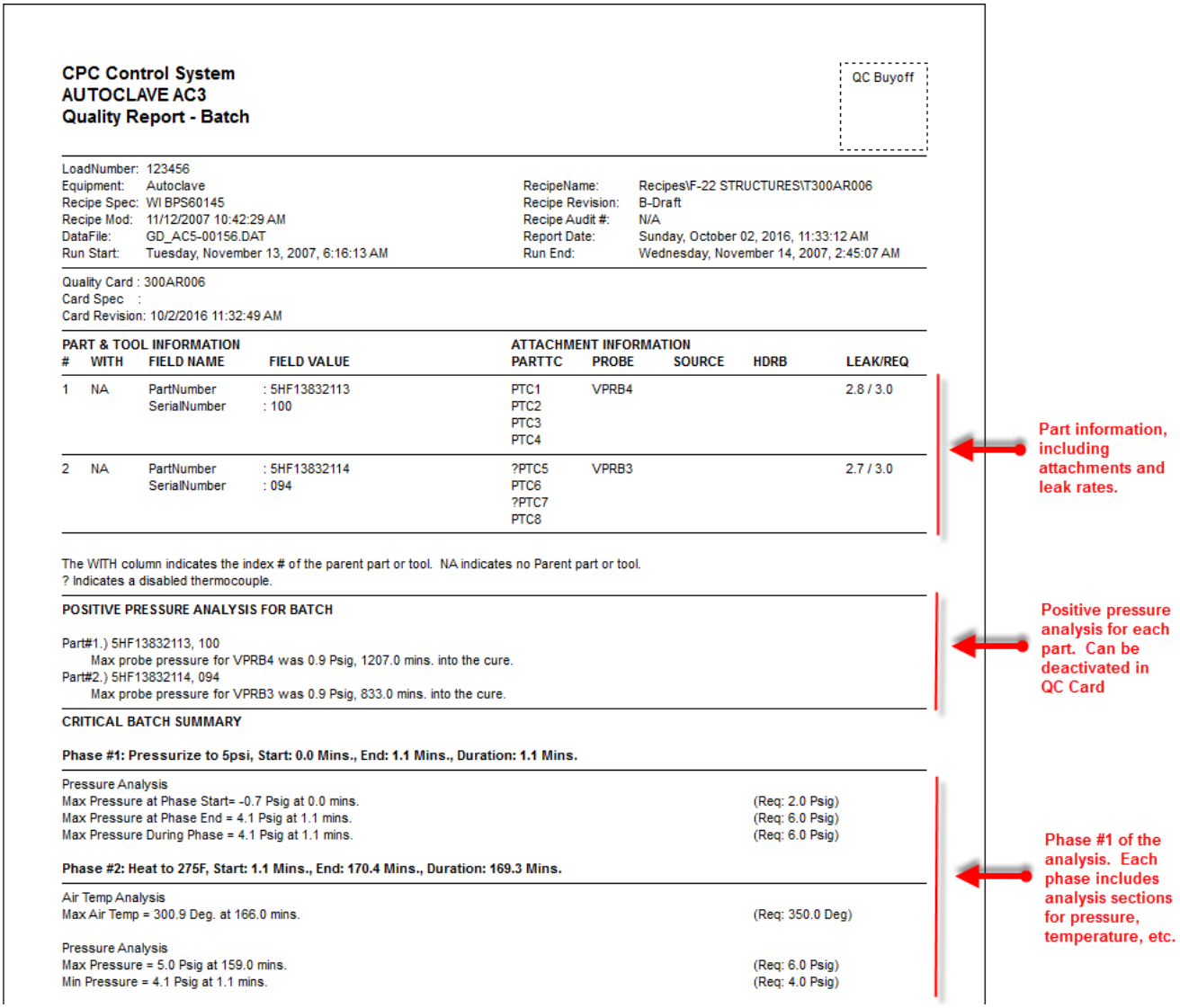
A quality card is a discrete software document within CPC that is used to analyze cure-cycle data to verify the process met specification. A quality card provides all the rules and criteria necessary to “Buyoff” the cure data to a customer’s cure specification.

Quality reports

Using Quality Cards, the system can analyze and report on the run data as a whole or for each individual part. Here are some examples of the quality reports.

"Quality Report – Batch"

This report is used to analyze the entire run's data without separating each part into different analysis sections. Because individual parts are not segregated, the temperature analysis includes all part thermocouples on all parts and the vacuum probe analysis utilizes all probes for all parts.



CPC Control System
AUTOCLAVE AC3
Quality Report - Batch

QC Buyoff

LoadNumber: 123456
Equipment: Autoclave
Recipe Spec: WI BPS60145
Recipe Mod: 11/12/2007 10:42:29 AM
DataFile: GD_AC5-00156.DAT
Run Start: Tuesday, November 13, 2007, 6:16:13 AM

RecipeName: Recipes\F-22 STRUCTURES\T300AR006
Recipe Revision: B-Draft
Recipe Audit #: N/A
Report Date: Sunday, October 02, 2016, 11:33:12 AM
Run End: Wednesday, November 14, 2007, 2:45:07 AM

Quality Card : 300AR006
Card Spec :
Card Revision: 10/2/2016 11:32:49 AM

PART & TOOL INFORMATION				ATTACHMENT INFORMATION				
#	WITH	FIELD NAME	FIELD VALUE	PARTTC	PROBE	SOURCE	HDRB	LEAK/REQ
1	NA	PartNumber SerialNumber	: 5HF13832113 : 100	PTC1 PTC2 PTC3 PTC4	VPRB4			2.8 / 3.0
2	NA	PartNumber SerialNumber	: 5HF13832114 : 094	?PTC5 PTC6 ?PTC7 PTC8	VPRB3			2.7 / 3.0

The WITH column indicates the index # of the parent part or tool. NA indicates no Parent part or tool.
? Indicates a disabled thermocouple.

POSITIVE PRESSURE ANALYSIS FOR BATCH

Part#1.) 5HF13832113, 100
Max probe pressure for VPRB4 was 0.9 Psig, 1207.0 mins. into the cure.
Part#2.) 5HF13832114, 094
Max probe pressure for VPRB3 was 0.9 Psig, 833.0 mins. into the cure.

CRITICAL BATCH SUMMARY

Phase #1: Pressurize to 5psi, Start: 0.0 Mins., End: 1.1 Mins., Duration: 1.1 Mins.

Pressure Analysis
Max Pressure at Phase Start= -0.7 Psig at 0.0 mins. (Req: 2.0 Psig)
Max Pressure at Phase End = 4.1 Psig at 1.1 mins. (Req: 6.0 Psig)
Max Pressure During Phase = 4.1 Psig at 1.1 mins. (Req: 6.0 Psig)

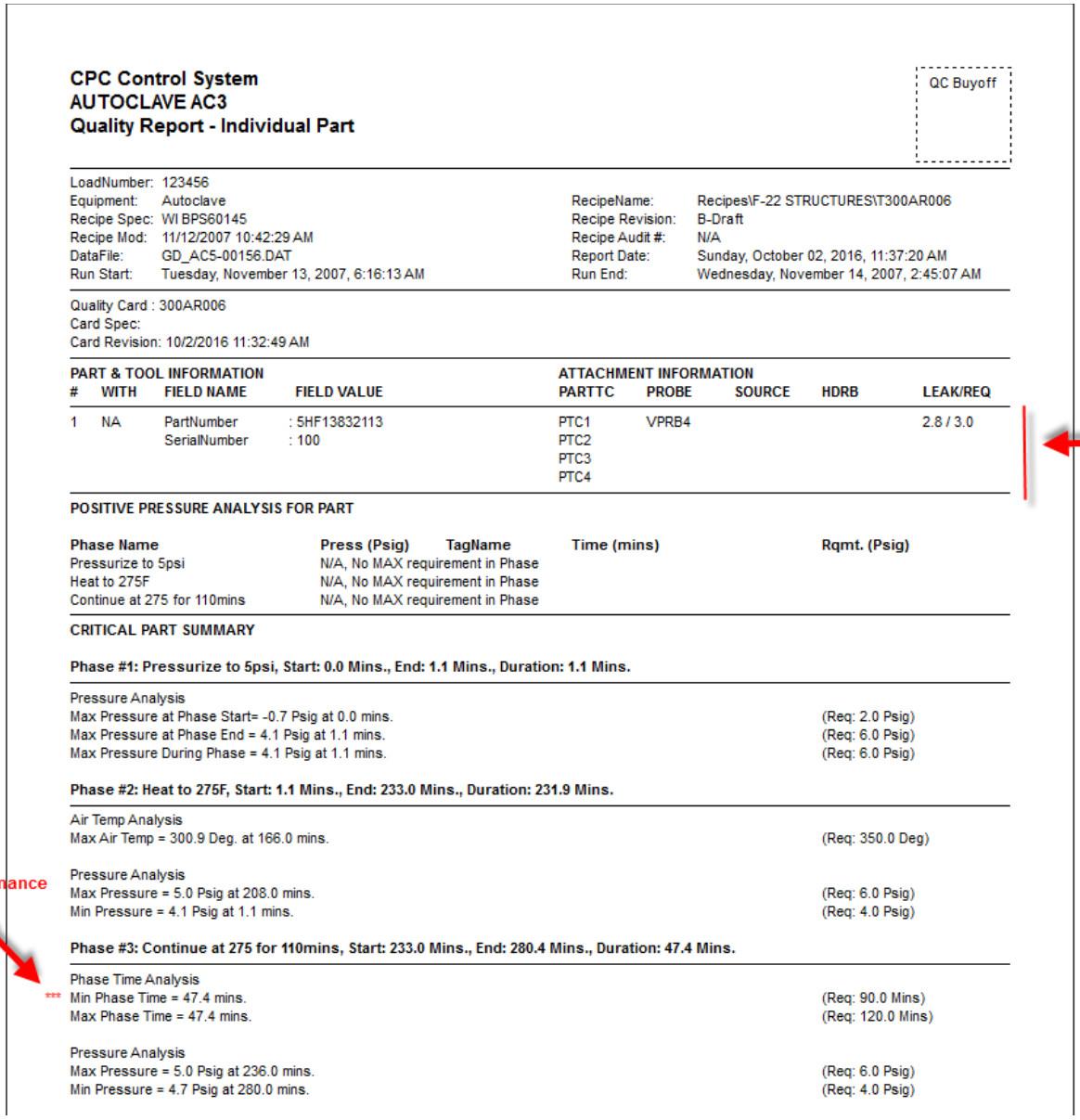
Phase #2: Heat to 275F, Start: 1.1 Mins., End: 170.4 Mins., Duration: 169.3 Mins.

Air Temp Analysis
Max Air Temp = 300.9 Deg. at 166.0 mins. (Req: 350.0 Deg)

Pressure Analysis
Max Pressure = 5.0 Psig at 159.0 mins. (Req: 6.0 Psig)
Min Pressure = 4.1 Psig at 1.1 mins. (Req: 4.0 Psig)

"Quality Report – All Parts"

This report is used to analyze the entire run's data, but provide a separate report for each part. In each individual part report, the analysis will utilize only the thermocouples and vacuum probes associated with the part. The report includes separate pages for each part in the run.



CPC Control System
AUTOCLAVE AC3
Quality Report - Individual Part

QC Buyoff

LoadNumber: 123456
Equipment: Autoclave
Recipe Spec: WI BPS60145
Recipe Mod: 11/12/2007 10:42:29 AM
DataFile: GD_AC5-00156.DAT
Run Start: Tuesday, November 13, 2007, 6:16:13 AM

RecipeName: Recipes\F-22 STRUCTURES\T300AR006
Recipe Revision: B-Draft
Recipe Audit #: N/A
Report Date: Sunday, October 02, 2016, 11:37:20 AM
Run End: Wednesday, November 14, 2007, 2:45:07 AM

Quality Card : 300AR006
Card Spec:
Card Revision: 10/2/2016 11:32:49 AM

PART & TOOL INFORMATION				ATTACHMENT INFORMATION				
#	WITH	FIELD NAME	FIELD VALUE	PARTTC	PROBE	SOURCE	HDRB	LEAK/REQ
1	NA	PartNumber	: 5HF13832113	PTC1	VPRB4			2.8 / 3.0
		SerialNumber	: 100	PTC2				
				PTC3				
				PTC4				

One report for each

POSITIVE PRESSURE ANALYSIS FOR PART

Phase Name	Press (Psig)	TagName	Time (mins)	Rqmt. (Psig)
Pressurize to 5psi	N/A, No MAX requirement in Phase			
Heat to 275F	N/A, No MAX requirement in Phase			
Continue at 275 for 110mins	N/A, No MAX requirement in Phase			

CRITICAL PART SUMMARY

Phase #1: Pressurize to 5psi, Start: 0.0 Mins., End: 1.1 Mins., Duration: 1.1 Mins.

Pressure Analysis
Max Pressure at Phase Start= -0.7 Psig at 0.0 mins. (Req: 2.0 Psig)
Max Pressure at Phase End = 4.1 Psig at 1.1 mins. (Req: 6.0 Psig)
Max Pressure During Phase = 4.1 Psig at 1.1 mins. (Req: 6.0 Psig)

Phase #2: Heat to 275F, Start: 1.1 Mins., End: 233.0 Mins., Duration: 231.9 Mins.

Air Temp Analysis
Max Air Temp = 300.9 Deg. at 166.0 mins. (Req: 350.0 Deg)

NonConformance

Pressure Analysis
Max Pressure = 5.0 Psig at 208.0 mins. (Req: 6.0 Psig)
Min Pressure = 4.1 Psig at 1.1 mins. (Req: 4.0 Psig)

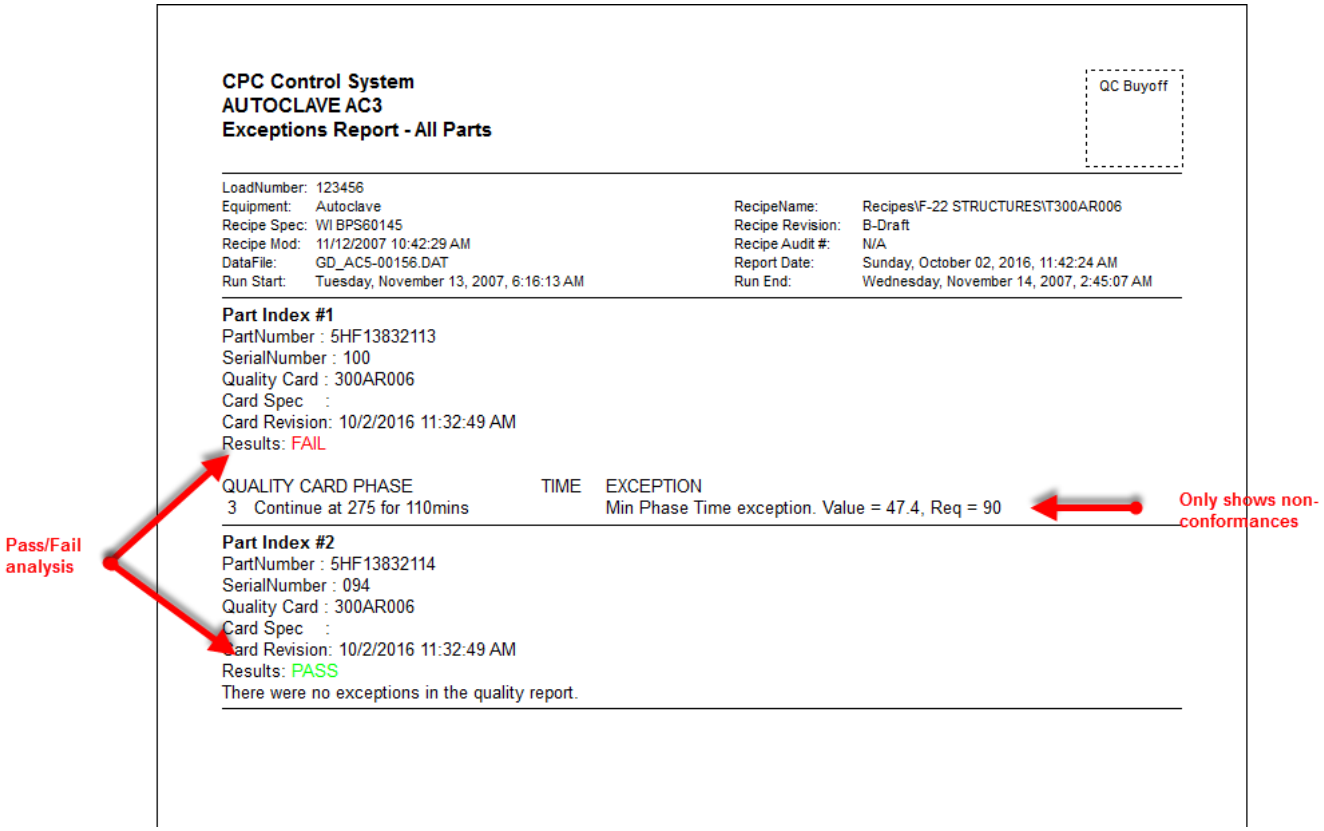
Phase #3: Continue at 275 for 110mins, Start: 233.0 Mins., End: 280.4 Mins., Duration: 47.4 Mins.

Phase Time Analysis
*** Min Phase Time = 47.4 mins. (Req: 90.0 Mins)
Max Phase Time = 47.4 mins. (Req: 120.0 Mins)

Pressure Analysis
Max Pressure = 5.0 Psig at 236.0 mins. (Req: 6.0 Psig)
Min Pressure = 4.7 Psig at 280.0 mins. (Req: 4.0 Psig)

"Exception Report - All Parts" Report

This report analyzes each part and provides a simplified Pass/Fail result along with some details about the quality phase and analysis section that created the non-conformance.



CPC Control System
AUTOCLAVE AC3
Exceptions Report - All Parts

QC Buyoff

LoadNumber:	123456		
Equipment:	Autoclave	RecipeName:	Recipes\F-22 STRUCTURES\T300AR006
Recipe Spec:	WI BPS60145	Recipe Revision:	B-Draft
Recipe Mod:	11/12/2007 10:42:29 AM	Recipe Audit #:	N/A
DataFile:	GD_AC5-00156.DAT	Report Date:	Sunday, October 02, 2016, 11:42:24 AM
Run Start:	Tuesday, November 13, 2007, 6:16:13 AM	Run End:	Wednesday, November 14, 2007, 2:45:07 AM

Part Index #1
PartNumber : 5HF13832113
SerialNumber : 100
Quality Card : 300AR006
Card Spec :
Card Revision: 10/2/2016 11:32:49 AM
Results: FAIL

QUALITY CARD PHASE	TIME	EXCEPTION
3 Continue at 275 for 110mins		Min Phase Time exception. Value = 47.4, Req = 90

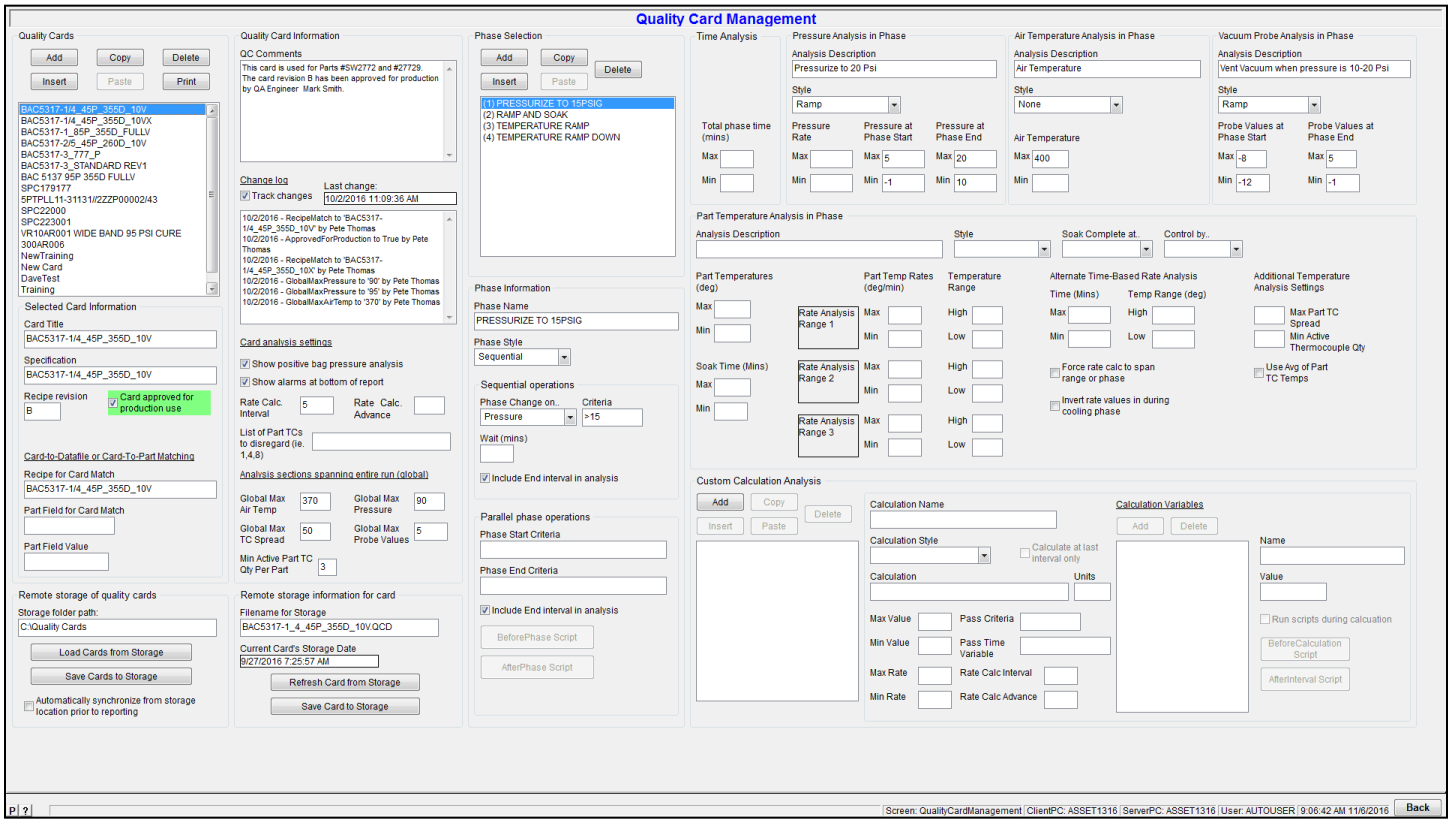
Part Index #2
PartNumber : 5HF13832114
SerialNumber : 094
Quality Card : 300AR006
Card Spec :
Card Revision: 10/2/2016 11:32:49 AM
Results: PASS
There were no exceptions in the quality report.

Pass/Fail analysis

Only shows non-conformances

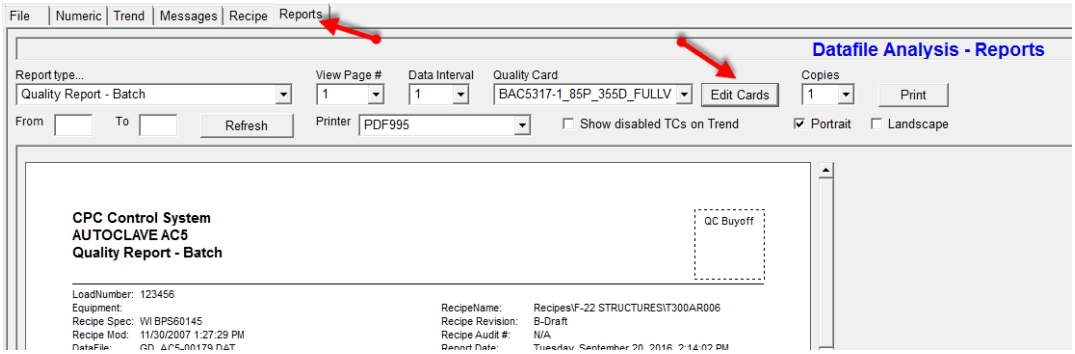
Quality Card Management screen

Quality cards are created, configured, and managed on the Quality Card Management screen.



How to access the screen

From the data-analysis reporting screen, click the “Reports” tab and then select the “Edit Cards” button.

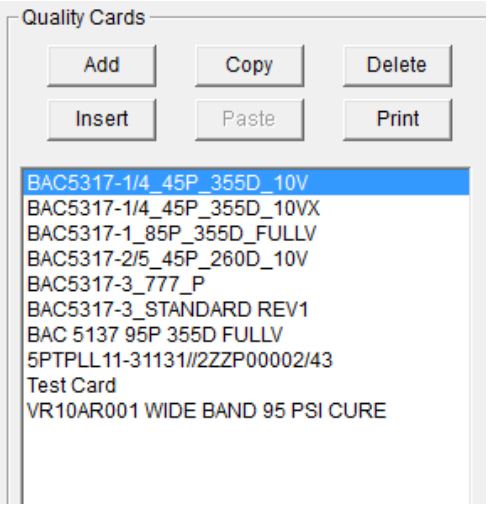


Security for screen

Though the Quality Card Management screen can be accessed and viewed by any operator of the software, creating/deleting/editing of cards is usually restricted to quality, engineering, or supervisor access (configurable permissions).

Creating and selecting card

Existing cards are listed on the screen. To select a card, click the title of the card in the list.



Operation buttons

The following card buttons are provided for quality cards.

Add

This button adds a new card below the current list selection. Once added, the default card title will be “NEW CARD” and a single phase called “New_Phase” will be added. Rename the card after creation.

Insert

Add a new card above the current list selection

Copy

Copies the currently selected card for future pasting.

Paste

Paste a previously copied card. The name will be appended with “ copy”

Delete

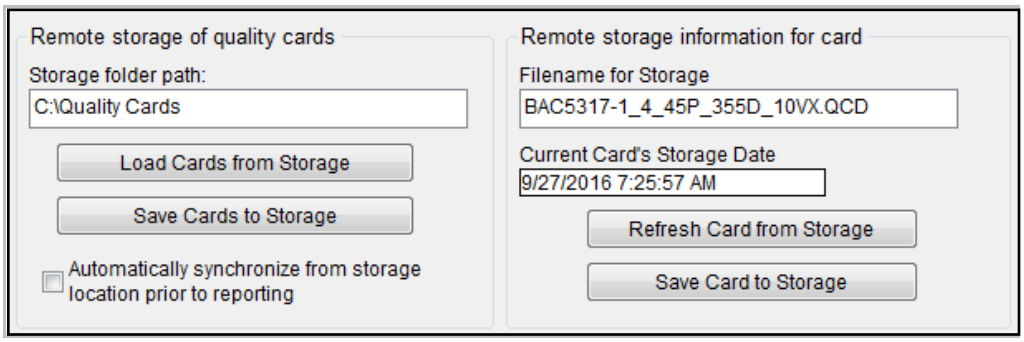
Delete the selected card. If the card is also stored remotely, the system will ask whether you also want to delete the card in storage.

Print

Print a report showing the card configurations

Card saving and loading

The default method of quality card storage is to have the cards stored in CPC Object.g file. In this method, there are no separate files for the cards. This method works fine for independent CPC systems, however if you want the same quality cards to be used by other CPC systems, then you will need to store the cards in a networked drive so that each CPC system can access them.



Setting up a remote storage location

Before you can save a card, you must enter the folder path for the remote storage. Normally this is targeting a network path (ie. \\Server\C\Quality Cards).

Storage Folder Path

This property sets the storage path. If blank, no saving or loading can be performed.

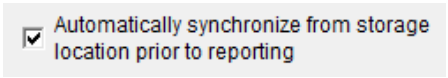
If files exist at the folder location, the Load and Refresh buttons will be enabled.

Enabling automatic synchronization and load

When cards are stored remotely, the system will not load those cards automatically unless you instruct it to do so. The option below will turn on this synchronization.

Automatically synchronize from storage

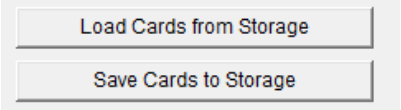
This checkbox will enable synchronization. If selected, the system will load into the system a new batch of cards each time the reporting screen is accessed.



It is import to note that if you use synchronization, the system will copy over all cards currently residing in your CPC software. This means that if you edit a card and forget to explicitly save it to storage, the synchronization feature will copy over your edited card without notice.

Saving and loading multiple cards

There are two buttons used for loading and saving all cards at once.



Load Cards from Storage

This button is enabled only if a folder has been configured. Clicking the button will instruct the system to load all cards that reside in the storage folder into the system. This performs the same function as the “synchronization”.

Because cards are sorted alphabetically in the storage folder, the cards will be loaded in alphabetical order, regardless of what order you initially created them in.

Any unsaved cards that are currently in the listing will remain.

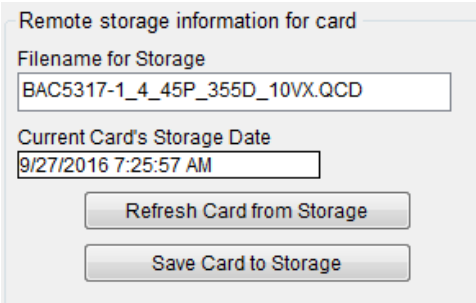
Save Cards to Storage

This button will save all cards in the list to the storage folder. If cards have previously not been saved, the system will name the file in upper case and based on the current card name. Also, the following characters will be converted to an underscore character: \ / : * ? " < > |

Here's an example:

Saving and refreshing individual cards

You can also individually save and load a card from storage.



Filename for Storage

This is the filename used for storage. You can edit this prior to saving, or you can have the system create the filename by pressing the "Save Card to Storage" button.

Refresh Card from Storage

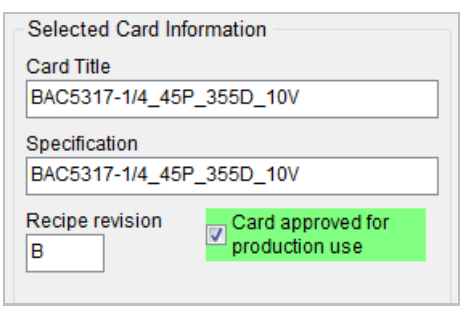
This button will load the .QCD files in the remote folder into the system. If cards exist with the same title, those cards will be updated and synchronized to the file values. This means that any changes you have made to the current cards will be deleted if you don't explicitly save the cards to storage.

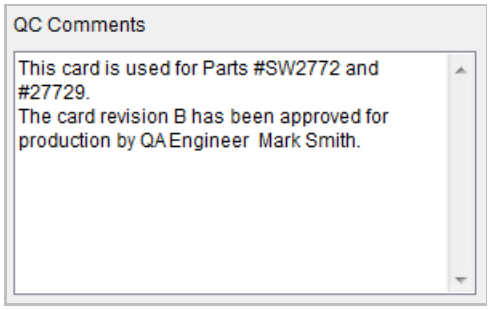
Save Card to Storage

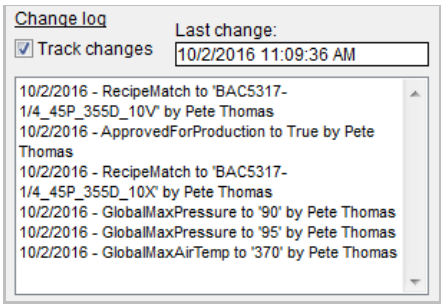
This button will save the current card to the storage location. If the Filename has not been entered, the system will select one based on the current card's title. Any card on the server with the same filename will be deleted with no prior confirmation request.

Card Information

Each card includes a title and a process specification. It also has information related to how the card will be automatically selected at the end of a run.







Card Title

This is the name of the card which will be shown in the listing.

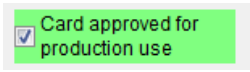
Specification

This is the process specification that the card will be configured to. The might be an internal customer document number or a specification standard (ie. Boeing # BAC5317-1/4)

Recipe revision

This indicates the revision number or letter for the card. This field is manually entered by the Quality Card programmer. The revision will be displayed on all quality reports.

Card approved for production use

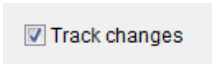


This setting indicates that the card is complete and ready for production operations. When a card is approved, change-tracking will be automatically enabled and the system will request extra confirmation (ie. “Are you sure?”) on each subsequent change to the card fields.

QC Comments

This field is used to record useful information about the card. It can also be usesd to identify the QC validation and approval information for the card.

Track changes



This setting turns on change-tracking in the card. Change-tracking will cause the system to log all future changes to the change-log. Once change-tracking is enabled, it cannot be turned off.

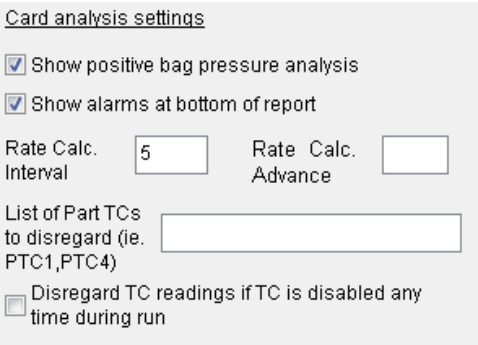
Change log

If “Track Changes” is enabled for a card, the system will record all changes to the card. This information will include the date, change and value, and the user who changed it.

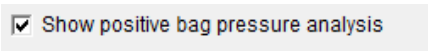
The “LastChange” property indicates the date and time of the last change.

Card Settings

There are a few card settings that can be used to modify how the card analyzes data and also what information is included in the quality reports.

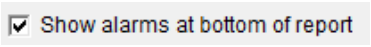


Show positive bag pressure analysis



This will enable the full-run, positive-pressure analysis which shows a table of maximum pressures for each part based on the part's vacuum probe readings.

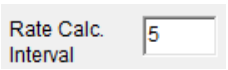
Show alarms at the bottom of report



This enables the printing of the alarms at the end of each quality report.

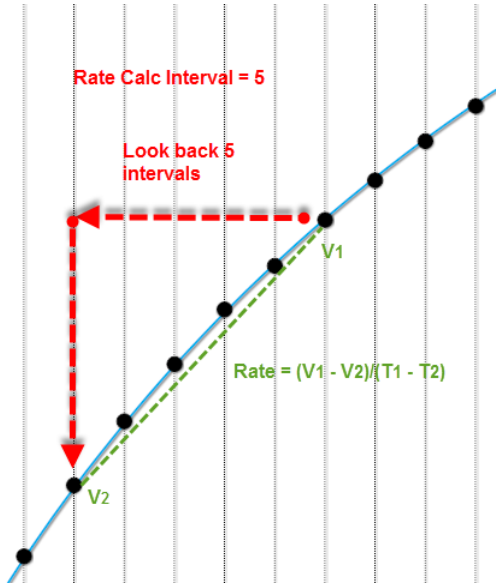
Rate Calc Interval

This parameter is used to define the default interval-based calculation method.



The quality card system utilizes a default rate calculation based on an interval-by-interval back-looking calculation. In this style of calculation, for each data point, its rate is calculated by taking the current value and a value from a prior data interval in the past and dividing by the time between those two intervals.

The Rate Calc Interval is the look-back data interval increment that will be used for the rate calculation. For example, if the data is collected every minute, an entry of 5 will tell the system to calculate rate based on a span of 5 minutes.

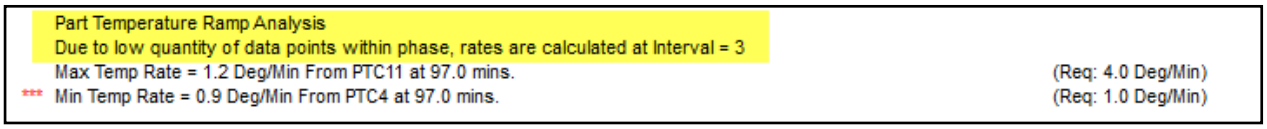


When the quality card analyzes rates (ie. temperature, pressure, etc.), it does so every data interval, but evaluates the current rate based on the calculation:

Rate = (Value(t) – Value(t-x)) / (Time(t) – Time(t-x)),

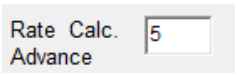
Where t = current interval and x = rate calc interval

If there aren't enough data intervals within a phase or range, the system will temporarily reduce the Rate Calc Interval and Advance to the highest value that will provide a single rate calculation. When this happens, the following message will be displayed, indicating the rate calc interval has been lowered for the analysis:



Rate Calc Advance

This setting instructs the system to start analyzing rates only after a specific number of intervals have occurred in the phase or range. This is used to guarantee that all points used in the rate calculation are in the phase or range.



A positive Advance setting instructs the system to start rate calculations after a specific number of intervals have occurred within a phase.

Advance also affects the rate calculations within a specified part temperature "Range" used for grouping different part temperature rates. If the Advance is entered, the system will automatically utilize only data points within the range for rate calculations.

Note: If there aren't enough data points within the phase or range, the RateCalcInterval will be purposely lowered to a value that allows at least one rate to be calculated.

Alternate rate calculation styles

Although ASC recommends using the incremental rate calculation method above, some specifications have different forms of rate calculation. CPC supports two other rate calculation methods:

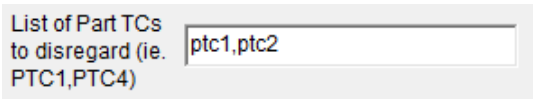
Spanning

In this rate calculation, a single calculation is used to determine the rate between two different ranges (ie. temperature, pressure). This is used by some specifications.

Time-based

This is a legacy style of rate calculation where times are utilized rather than actual rates. In this style of rate analysis, the time between two temperatures is analyzed.

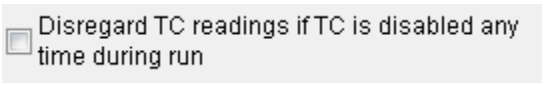
List of Part TCs to disregard



This is a comma-delimited list of thermocouple sensors representing the thermocouples that should be disregarded during the report. This feature is used only when you have some questionable part temperatures that you believe are not representing the actual part temperature (ie. thermocoupe comes off the part).

The output on the report will display a message in each section showing the disregarded thermocouples.

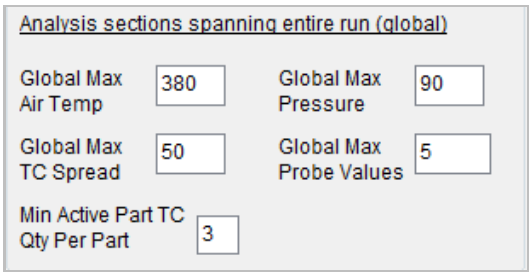
Disregard disabled TCs for entire run



As a default the analysis system automatically disregards TC values once the TC sensors are disabled (ie. faulty thermocouple). If you would rather the the system disregard those disabled TC values for the entire run, then set this option to true.

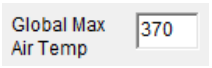
Global analysis of entire run

Although the card can be configured with independent time phases, there are a ffew global analysis features that provide an easy way to analyze all data in the run. By entering a value into these entries, you will request the specific analysis and results.

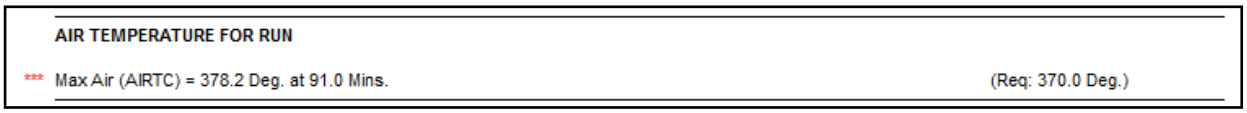


Global Max Air Temp

This entry enables the analysis of the maximum Air Temperature during the entire run. The report will include the maximum air temperature achieved, the time that this was achieved, the alarm limit, and an out-of-tolerance indication (***).



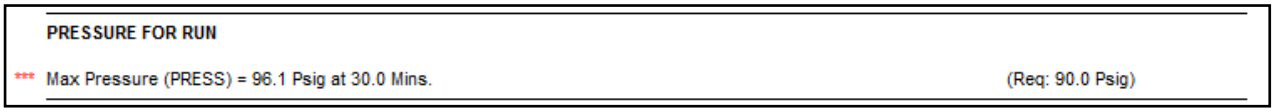
Here's an example of what will would be displayed on the report.



Global Max Pressure

This entry enables the analysis of the maximum Pressure during the entire run. The report will include the maximum pressure achieved, the time that this was achieved, the alarm limit, and an out-of-tolerance indication (***).

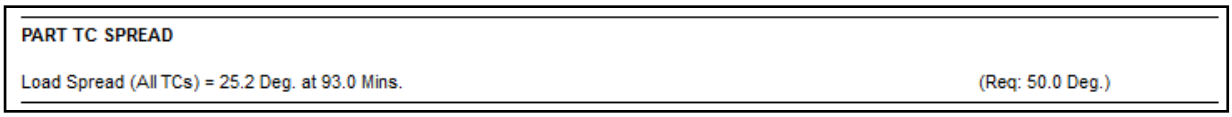
Here's an example of what will would be displayed on the report.



Global Max TC Spread

This entry enables the analysis of the maximum temperature difference across all active part thermocouples. The report will include the maximum spread achieved, the time that this was achieved, the alarm limit, and an out-of-tolerance indication (***).

Here's an example of what will would be displayed on the report.



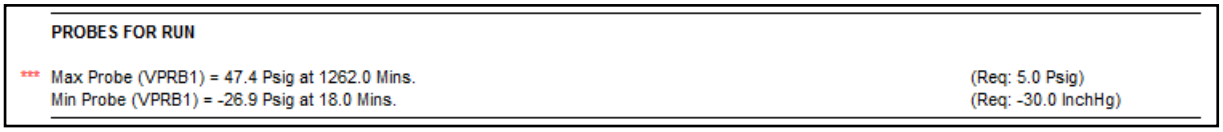
PART TC SPREAD

Load Spread (All TCs) = 25.2 Deg. at 93.0 Mins. (Req: 50.0 Deg.)

Global Max Probe Values

This entry enables the analysis of the maximum vacuum line probe readings. The report will include the maximum probe vacuum/pressure, the time that this was achieved, the alarm limit, and an out-of-tolerance indication (***).

Here's an example of what will would be displayed on the report.



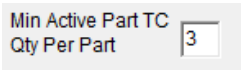
PROBES FOR RUN

*** Max Probe (VPRB1) = 47.4 Psig at 1262.0 Mins. (Req: 5.0 Psig)
Min Probe (VPRB1) = -26.9 Psig at 18.0 Mins. (Req: -30.0 InchHg)

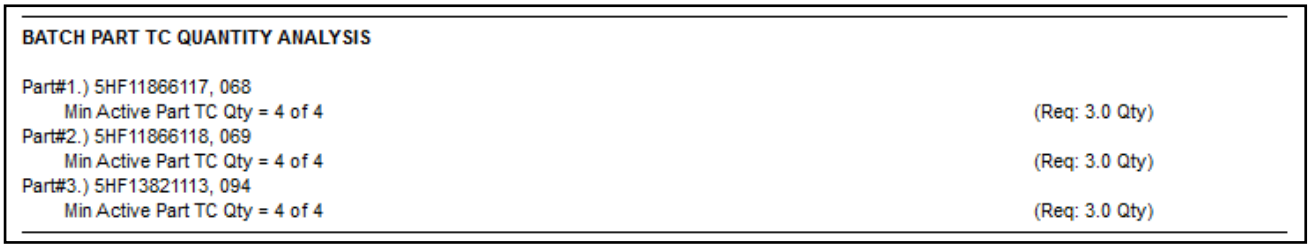
Note: The minimum probe reading is included in the analysis with an alarm limit of -30"Hg.

Min Active Part TC Qty Per Part

This entry instructs the system to analyze the minimum number of active part thermocouples for each part during the run. If a thermocouple becomes disabled, the minimum count will reflect that. This becomes a minimum limit. The report will include the minimum quantity, the alarm limit, and an out-of-tolerance indication (***) if there are fewer thermocouples on a given part.



Here's an example of what will would be displayed on the Quality Batch report. For each part the system will show you the minimum and the total starting quantity (ie. Qty = 4 of 4)



BATCH PART TC QUANTITY ANALYSIS

Part#1.) 5HF11866117, 068
Min Active Part TC Qty = 4 of 4 (Req: 3.0 Qty)
Part#2.) 5HF11866118, 069
Min Active Part TC Qty = 4 of 4 (Req: 3.0 Qty)
Part#3.) 5HF13821113, 094
Min Active Part TC Qty = 4 of 4 (Req: 3.0 Qty)

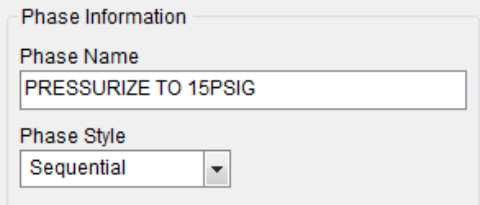
Note that this report's analysis is affected by the "Disregard Part TC" option.

Phase analysis

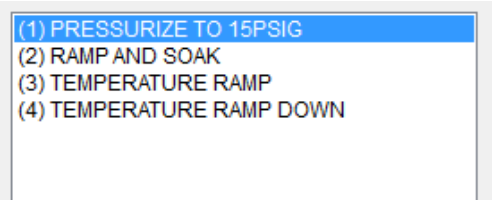
If you want to analyze run data for a specific ranges of time during the run, you will need to use Phase analysis.

What is a phase?

A phase is a named range of time during which specific data analysis will occur. Phases can operate sequentially or in parallel with other phases. When sequential, each phase's end interval becomes the starting point for the next card's analysis range.



A configured quality card will include multiple phases, each of which include multiple analysis sections which define the type of analysis that will occur.



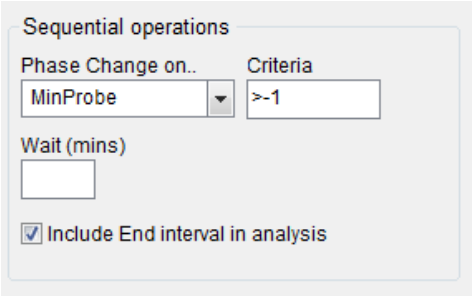
The phase's index and title will be displayed in the list. Sequential phases are indexed by sequential number (ie. 1,2,3) while parallel phases use a "P" designation and a separately indexed number (ie. P1, P2, etc.)

Phase Styles

The "Phase Style" drop-down is used to select either Sequential or Parallel.

Sequential

Sequential phases start at the first data interval of the run and link together. For this reason, sequential phases cannot analyze the same time ranges of the run.

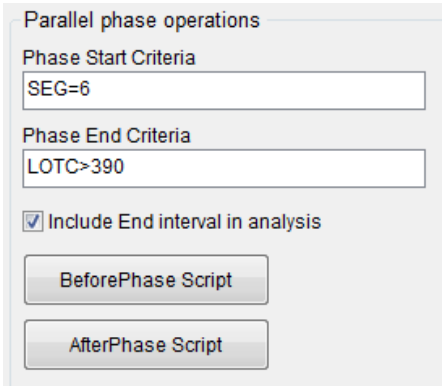


When you configure multiple sequential phases, the first phase starts at Interval=1 and all other phases start when the previous phase ends.

Sequential Phase #1	Starts at 1st data interval and ends at the data interval that meets the change criteria.
Sequential Phase #2	Starts at the same interval as Phase #1 end interval and ends at the data interval that meets the change criteria.
Sequential Phase #3	Starts at the same interval as Phase #2 end interval and ends at the data interval that meets the change criteria.

This option instructs the system to include the final interval in the analysis of each phase. The final interval is the one that meets the "Phase Change on" criteria. So, for example, if the phase changes on Pressure > 90 and option is enabled, the final analyzed interval will include the interval that has Pressure > 90.

Parallel style



A parallel phase is one that operates independently of other phases. In this type of phase, you will define the start and end of the phase by entering a Start Criteria and End Criteria. These criteria fields use comparative and conditional analysis of any input value stored to the datafile (ie. AIRTC, PRESS, etc.)

Parallel phases are useful when you want to target a specific range of data that doesn't fit nicely into a sequence, or if you want to utilize some of the advanced features such as calculations and scripting.

When does a phase begin?

For Sequential phases

The first sequential phase starts at the first data interval of the datafile.

Subsequent sequential phases will begins at the end interval of the previous sequential phase. The end interval will be the segment that matches the prior phase's "Segment Change On" criteria. So, for example, if the previous phase ends with "Pressure > 95", the first data interval of the next phase will have pressure greater than 95.

For Parallel phases

The phase begins when the conditions in the "Phase Start Criteria" setting are met. The criteria can be any valid conditional statement using the saved input names.

Some examples are:

AIRTC > 200

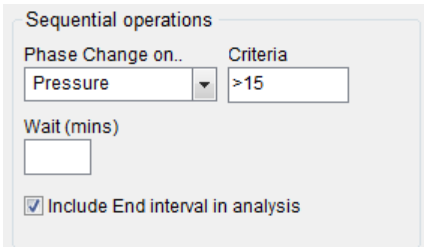
PRESS > 5 and SEG=5

ABS(PSET-PRESS)>10

When does a phase end?

Sequential phase end

The phase ends when the pre-configured phase change criteria is met. This is configured using the "Phase Change On" drop-down menu and the "Criteria" text entry.



If the "Include End Interval in Analysis" is checked (default), the phase will include the interval data that met the change criteria. If you don't want this included in the analysis, deselect the option.

The “Phase Change On” drop-down and the “Criteria” entry is used to define when the phase will end. The options available for the drop-down are:

AirTemp	Usually the AIRTC input. See Data-Analyze->AirTempTag property.
Pressure	Usually the PRESS input. See Data-Analyze->PressureTag property.
MinPartTemp	Lowest part thermocouple reading in each data interval. For a “Quality Batch“ report, this represents the lowest of all thermocouples. For a “Quality All Parts” report, this will only represent the thermocouples attached to each analyzed part. Only readings of “enabled” thermocouples will be considered.
MaxPartTemp	Highest part thermocouple reading in each data interval. For a “Quality Batch” report, this represents the lowest of all thermocouples. For a “Quality All Parts” report, this will only represent the thermocouples attached to each analyzed part. Only readings of “enabled” thermocouples will be considered.
MinProbe	Lowest vacuum probe reading in each data interval. For a “Quality Batch” report, this represents lowest of all thermocouples. For a “Quality All Parts” report, this will only represent the probes attached to each analyzed part. Because vacuum is usually displayed as a negative value, the MinProbe would represent the best/strongest vacuum level.
MaxProbe	Lowest vacuum probe reading in each data interval. For a “Quality Batch” report, this represents lowest of all thermocouples. For a “Quality All Parts” report, this will only represent the probes attached to each analyzed part. Because vacuum is usually displayed as a negative value, the MaxProbe would represent the worst/weakest vacuum level.
SoakComplete	This entry is only used if you are using the RampSoak part temperature phase analysis. In this case, the system analyzes both the ramp and the soak of parts, independent of the actual recipe segment. Once all parts have completed their soak (as defined in Part Temp section), the phase will change.
TimeInPhase	This represents the elapsed time in the current phase in minutes.
Segment	This represents the SEG input, which defines the recipe segment at the time of the data interval.
SegmentTime	This represents the SEGTIME input, which is the elapsed segment time during the specific data interval.
SegmentChange	This setting doesn’t use the Criteria, and will instruct the system to change phases when the SEG input changes. This is useful in cases where you want sequential phases to mirror the recipe segments.
End	This represents the end of the datafile. It should only be used in the last sequential phase.

For Parallel phases

The phase end is determined by the “Phase End Criteria”. If blank, the phase will end at the last data interval of the run. If a criteria is entered (ie. PRESS > 99), then the phase will end at the data interval that meets the criteria.

Here are some examples:

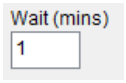
LOTC>340

LOTC>340 AND SEG=5 AND SEGTIME>60

ABS(HITC-LOTC)<20

Other phase settings

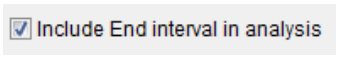
Wait setting



This is used for Sequential phases only. It is entered in units =minutes and instructs the system to skip ahead in time before starting to check the phase-change criteria. This is a fault-tolerance mechanism to avoid erroneous phase changes, especially in cases where there might be noisy data at the beginning of a phase and you want to wait for stability.

For parallel phases, you can use the “BeforePhase” script to chang the start interval after it’s been evaluated.

Include End Interval in analysis



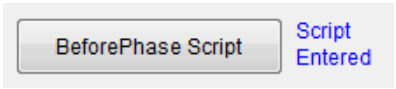
This check-box is used for Sequential and Parallel phases. It instructs the system to include the last interval of the phase in the analysis.

For example, in a sequential phase if the Phase-Change is “Pressure” and the criteria is “>100”, the first interval where pressure is greater than 100 will not only cause a phase change but will be included as the last analyzed interval in the phase.

In a parallel phase, if the End Criteria = “AIRTC >250”, if the option is checked the analysis will include the interval where Air Temperature was greater than 250 degrees.

The default value is True (checked).

BeforePhase script



This button will access the custom scripting language. This script can be used in cases where you want to dynamically modify phase and calculation properties prior to the phase analysis. The script will run immediately after the phase StartInterval and EndInterval are determined, but before any analysis occurs.

Another use for the BeforePhase script is to manipulate the StartInterval and EndInterval prior to analysis. The system will expose these values on the Phase object.

The following properties are set by the system after evaluating StartCriteria and EndCriteria, but before running the actual analysis. You can use these properties in the script:

StartInterval	1
StartTime	0
EndInterval	297
EndTime	290.0333

StartInterval: First data interval that met the StartCriteria.

StartTime: Elapsed run time at Start Interval.

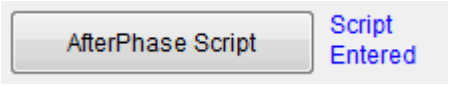
EndInterval: End data interval that met the EndCriteria.

EndTime: Elapsed run time at End Interval.

Example: The below script increments the StartInterval by 5 intervals and the end index is decremented by 2.

```
Sub First_Heating_Ramp_BeforePhase()

   Me\StartInterval = Me\StartInterval + 5

EndSub
```

AfterPhase script

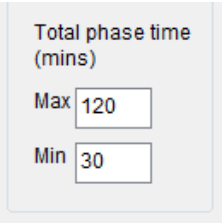


This button will access the custom scripting language. This script is primarily used to dynamically modify the phase and calculation properties for the next phase. The script will run immediately after the phase analysis is complete, but before the next phase's start and end are calculated.

Note: If you intend to manipulate phase objects directly, you should make sure your phase names do not include spaces. Spaces are not recognized in object path callouts. Instead, you can use the underscore _ instead of the spaces.

Time analysis section

This section analyzes the length of the specific phase and reports an exception if the time exceeds the Min or Max. If the value is blank, no analysis will occur.



Min setting

This setting enables the analysis of the minimum elapsed phase time. If the time is less than the min, an out-of-tolerance condition will be set.

Max setting

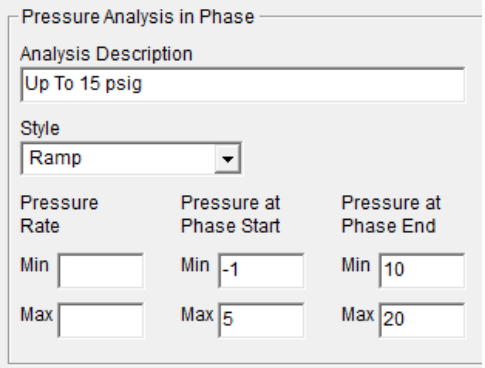
This setting enables the analysis of the maximum elapsed phase time. If the time is more than the max, an out-of-tolerance condition will be set.

Example of report

Here's what it will display on the report.

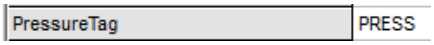
Pressure analysis section

This section can be used to analyze the pressure input (PRESS) during the phase.



What input is analyzed?

On most systems the pressure input is named PRESS, however this is not always the case. The DataAnalyze object property "PressureTag" instructs the reporting system on the name of this sensor.



Style

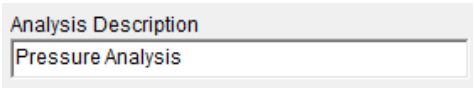
This drop-down selection is used to define which style of pressure analysis will occur. The options are:

None (or blank) – No analysis will occur in the phase.

Hold – Analysis assumes that the pressure setpoint is holding at one setpoint level and the system will analyze mininimum and maximum based on the "Pressure at Phase Start" entries.

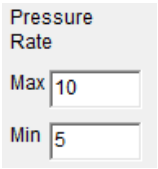
Ramp – Analysis asssumes that the pressure setpoint is rising or falling. In this style, if the rate Min or Max is entered, the system will analyze the rate of change of the pressure during the phase (ie. psig/min). The system will only analyze the actual pressure value at the Start (first interval of the phase) and End (last interval of the phase) based on the Min and Max entered values.

Analysis description



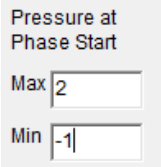
This will show as the section title on the quality reports. If you leave it blank, the system will report a title "Pressure Hold Analysis" and "Pressure Ramp Analysis" respectively.

Rate entries



These are only analyzed for Style = Ramp. If Min limit is entered, the system will analyze the phase data, determine the lowest rate, and then report on that. If Max limit is entered, the system will analyze the phase data, determine the highest rate, and then report on that. The RateCalcInterval and RateCalcAdvance will be used for the analysis.

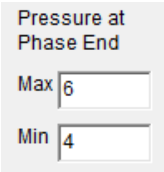
Pressure at Phase Start



For Style = Hold: If Min limit is entered, the system will analyze the phase data, determine the lowest value, and then report on that. If Max limit is entered, the system will analyze the phase data, determine the highest value, and then report on that.

For Style = Ramp: If Min limit is entered, the system will analyze the all phase data points, determine the lowest value, and then report on that. If Max limit is entered, the system will analyze all phase data points, determine the highest value, and then report on that.

Pressure at Phase End

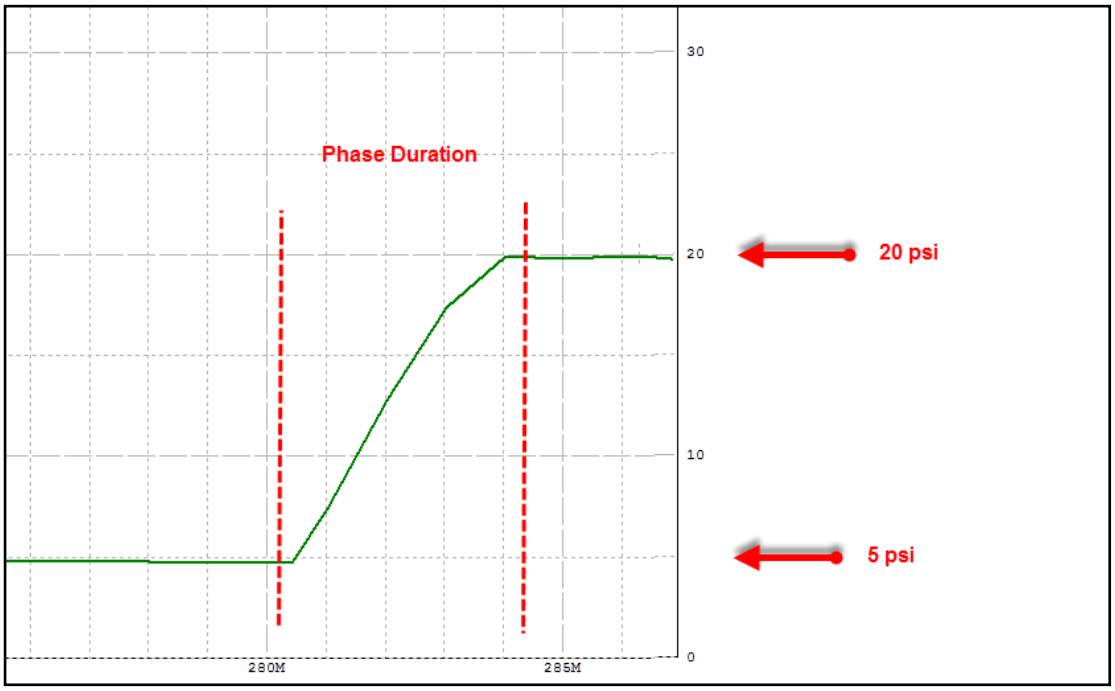


When Style = Hold, this is unused.

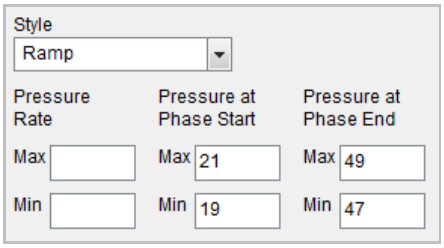
When Style = Ramp, if Min limit is entered, the system will analyze the last data point in the phase and report on whether the Pressure is lower than the Min limit. If Max limit is entered, the system will analyze the last data point in the phase and report on whether the Pressure is higher than the Max limit.

Example #1: Ramp style using PressureAtStart and PressureAtEnd

Here's a pressurization from 5 psi to 20 psig.



If you're interested in a min and max pressure during the ramp, but not interested in the actual ramp rate, you can use the Pressure entries below:

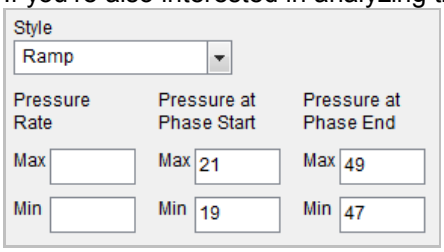


Here's the report output:

Pressure Analysis	
Max Pressure at Phase Start= 4.7 Psig at 280.02 mins.	(Req: 6.0 Psig)
Min Pressure at Phase Start= 4.7 Psig at 280.02 mins.	(Req: 4.0 Psig)
Max Pressure at Phase End = 19.9 Psig at 284.05 mins.	(Req: 21.0 Psig)
Min Pressure at Phase End = 19.9 Psig at 284.05 mins.	(Req: 19.0 Psig)
Max Pressure During Phase = 19.9 Psig at 284.05 mins.	(Req: 21.0 Psig)
Min Pressure During Phase = 4.7 Psig at 280.02 mins.	(Req: 4.0 Psig)

Example #2: Ramp style using Pressure Rate, PressureAtStart and PressureAtEnd

If you're also interested in analyzing the ramp rate, then you can add Min Rate and Max Rate:

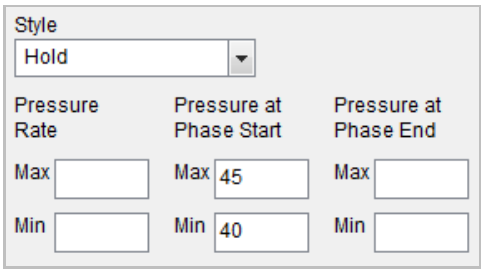


Here's the report output:

Pressure Analysis	
Max Pressure at Phase Start= 4.7 Psig at 280.02 mins.	(Req: 6.0 Psig)
Min Pressure at Phase Start= 4.7 Psig at 280.02 mins.	(Req: 4.0 Psig)
Max Pressure at Phase End = 19.9 Psig at 284.05 mins.	(Req: 21.0 Psig)
Min Pressure at Phase End = 19.9 Psig at 284.05 mins.	(Req: 19.0 Psig)
Max Pressure During Phase = 19.9 Psig at 284.05 mins.	(Req: 21.0 Psig)
Min Pressure During Phase = 4.7 Psig at 280.02 mins.	(Req: 4.0 Psig)
Max Pressure Rate during phase= 4.21 Psig/min at 283.03 mins.	(Req: 6.00 Psig/min)
Min Pressure Rate during phase= 4.18 Psig/min at 284.05 mins.	(Req: 2.00 Psig/min)

Example #3: Hold style using PressureAtStart

For Hold style, you only need to enter the "Pressure At Start" settings:

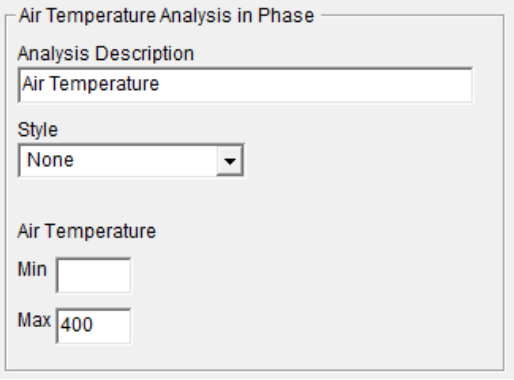


Here's the report output:

Pressure Analysis	
Max Pressure = 47.5 Psig at 293.03 mins.	(Req: 49.0 Psig)
Min Pressure = 47.1 Psig at 443.02 mins.	(Req: 45.0 Psig)

Air temperature analysis section

This section can be used to analyze the air temperature input (AIRTC) during the phase.



The following fields are provided for air temperature analysis in the phase:

What input is analyzed?

On most systems the air temperature input is named AIRTC, however this is not always the case. The DataAnalyze object property "AirTempTag" instructs the reporting system on the name of this sensor.

Style

The style pull-down selection determines if and what type of air temperature analysis will occur in the phase:

None No analysis during phase

Max Maximum temperature analysis only

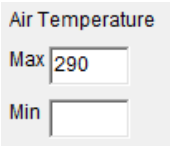
MinMax Minimum and Maximum temperature analysis

Note: a blank style is the same as None

Analysis Description

This is the title of the air temperature analysis. If this is blank, the system will automatically title the analysis section "Air Temperature Analysis"

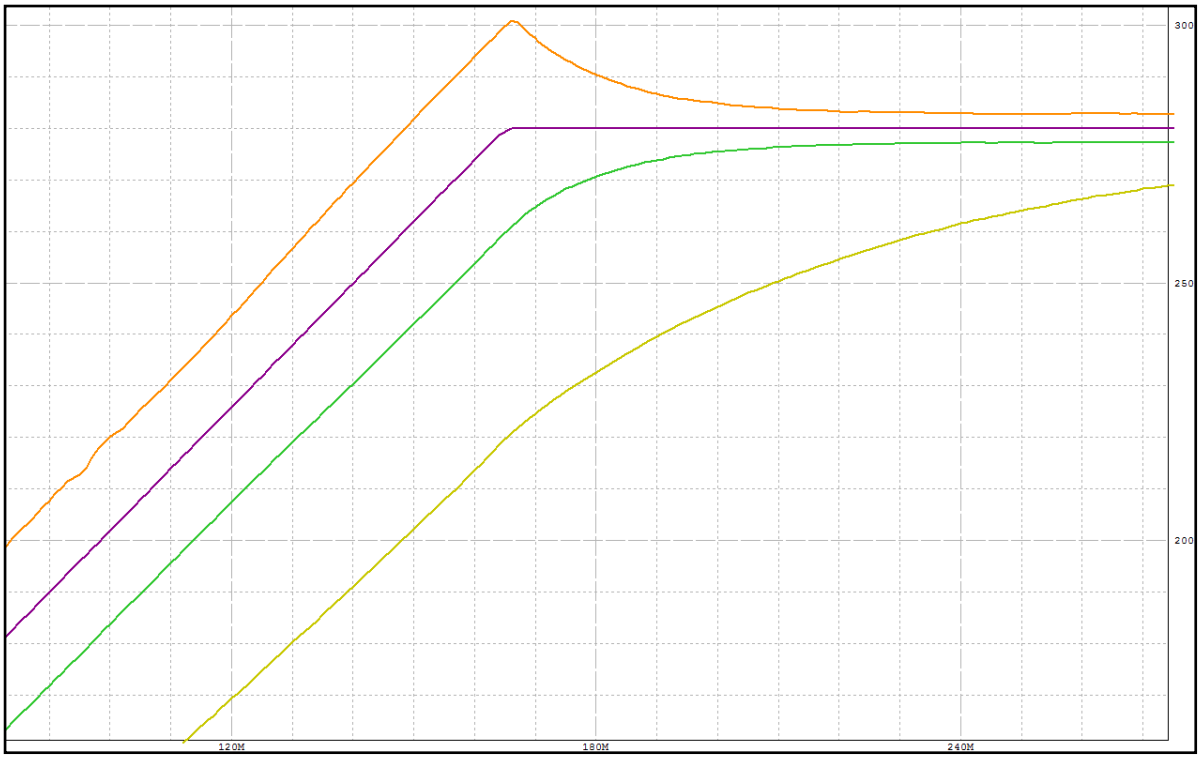
Min and Max settings



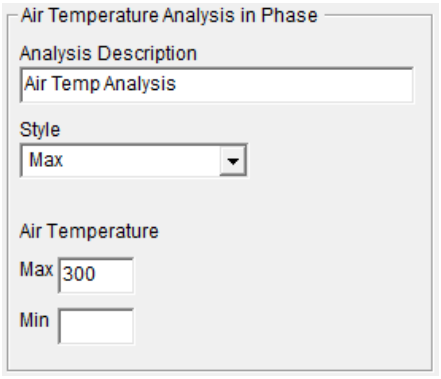
If either of these fields are entered, than the system will analyze the air temperature (in degrees) and provide reporting statistics and exception indications based on the field entries :

Example of air temp

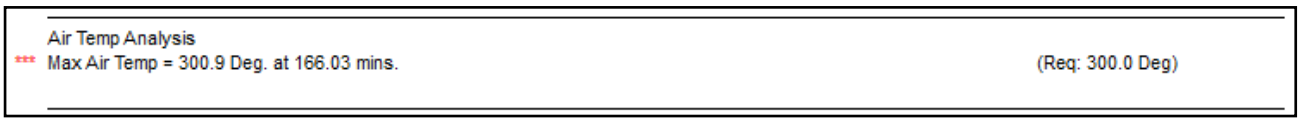
Here's an air-temperature overshoot above 300F during a 280 F soak.



Here are the settings with a max check of 300:

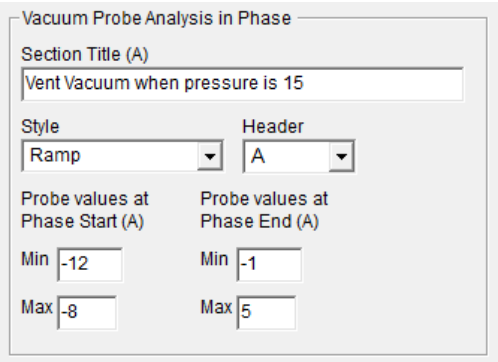


Here's what it will display on the report:



Vacuum probe analysis section

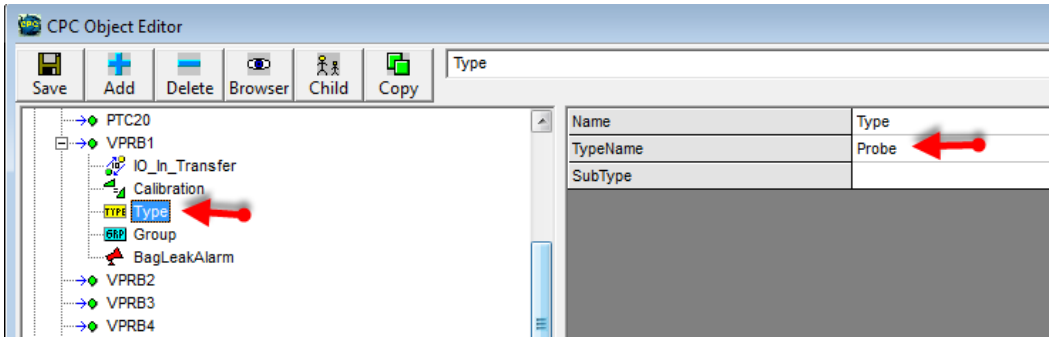
This section can be used to analyze the part's vacuum probe inputs (ie. VPRB1) during the phase. The analysis includes a value analysis at the beginning and end of the phase.



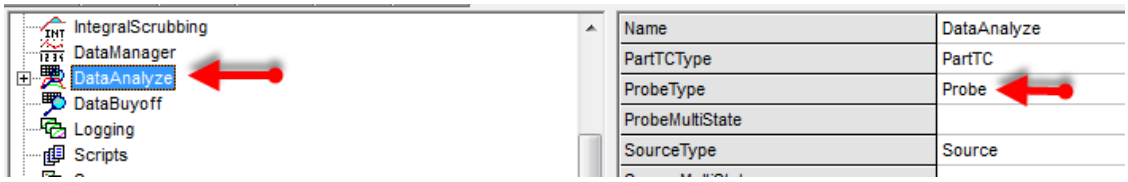
Note: this analysis does not analyze rates of change of vacuum. This may be added in the future if a customer requests the capability.

How does the card recognize vacuum probe data?

The input names for vacuum probes can be different from system to system. ASC's general rule is to name these with the prefix VPRB, however some customers use PV and others use MON (monitor). In order to provide a recognizable classification of these inputs, a "Type" object is placed under each vacuum probe input and its TypeName property is defined. The TypeName used for vacuum probes is usually "Probe".



When the data is saved during a run, the datafile includes an InputNames record which includes the name of the input, the units, and the TypeName of the input. It is this record's information that instructs the card to which input is a vacuum probe. Additionally, in the DataAnalyze object, the "ProbeType" property lets the card know which typename to look for.

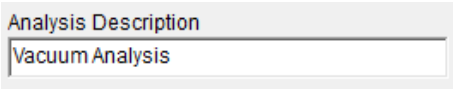


Part or Batch analysis

Vacuum probes are typically enabled only if they are attached to a part in the run. As such, the set of vacuum probes analyzed will change depending on whether you are interested in generating a "Batch" quality report or an an "All Parts" quality report.

In the case of the Batch report, all vacuum probes in the run will be analyzed together. In the case of the All Parts report, only those probes attached to each part will be analyzed. This will result in different results for each processed part.

Analysis Description



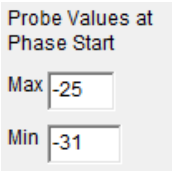
This is the title of the air temperature analysis. If this is blank, the system will automatically title the analysis section "Air Temperature Analysis"

Style

The style pull-down selection determines if and what type of probe analysis will occur in the phase:

None or blank	No analysis during phase
Ramp	Analyzes vacuum/pressure level at start of phase and at end of phase only.
Hold	Analyzes vacuum/pressure level throughout phase based on the "Probe Values At Phase Start" Min and Max entries.

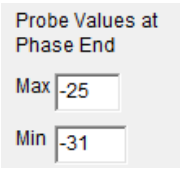
Probe Limits At Start



For Style=Hold, this will define the Min and Max limits for the entire phase.

For Style=Ramp, this will define the Min and Max limits for analysis of the first data interval of the phase.

Probe Limits At End

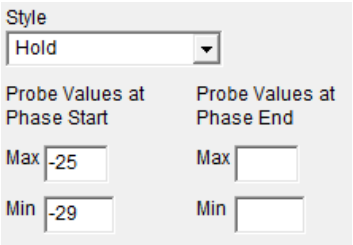


For Style=Hold, this is not used. The Start limits will be used for the analysis during the entire phase.

For Style=Ramp, this will define the Min and Max limits for analysis at the last data interval of the phase.

Example of Hold style

For a phase where vacuum probes are expected to hold, you only have to program a Vacuum At Start criteria. The system will analyze Min and Max throughout the entire phase:

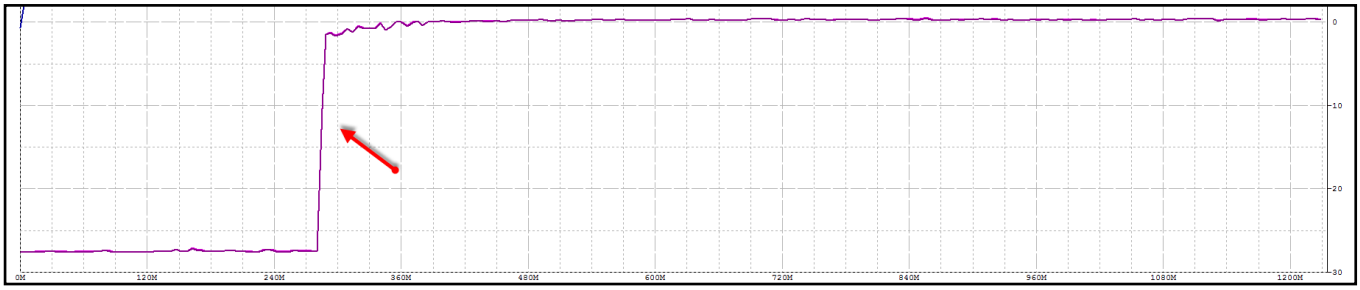


Here's the output

```
Vacuum Hold analysis
Max Vacuum = -26.9 InchHg From VPRB3 at 161.03 mins.        (Req: -25.0 InchHg)
Min Vacuum = -27.6 InchHg From VPRB4 at 127.02 mins.        (Req: -29.0 InchHg)
```

Example of Ramp style

For a change of vacuum during the phase, you can evaluate one set of criteria at the start of the phase and one at the end.



Style: Ramp

Probe Values at Phase Start		Probe Values at Phase End	
Max	-25	Max	2
Min	-29	Min	-2

Here's the output

```
Vacuum Hold analysis
Max Vac at Phase Start= -27.4 InchHg From VPRB3 at 240.03 mins.   (Req: -25.0 InchHg)
Min Vac at Phase Start= -27.5 InchHg From VPRB4 at 240.03 mins.   (Req: -29.0 InchHg)
Max Vac at Phase End= -1.1 InchHg From VPRB3 at 300.02 mins.      (Req: 2.0 Psig)
Min Vac at Phase End= -1.1 InchHg From VPRB4 at 300.02 mins.      (Req: -2.0 InchHg)
```

Analyzing with multiple headers

On systems with multiple vacuum headers, the Quality Card Management system is will provide two sets of vacuum probe analysis settings. Usually, these headers will be designated as Header A and Header B. In this configuration, you can have some of the probes analyzed to one vacuum (A) and other probes analyzed to the second vacuum (B) level.

Vacuum Probe Analysis in Phase

Section Title (A): Vacuum Analysis

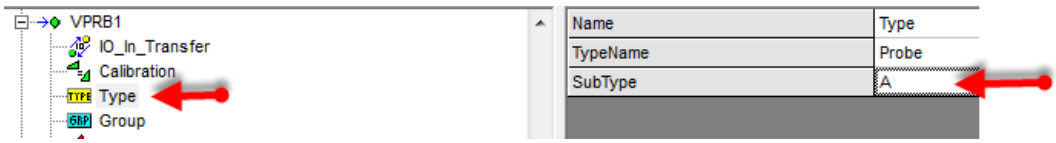
Style: Hold — Header: A

Probe values at Phase Start (A)		Probe values at Phase End (A)	
Max	-25	Max	
Min	-31	Min	

In order to use multiple vacuum headers, the DataAnalyze object's "QualityDualHeaders" property must be set to True.

QualityDualHeaders	True

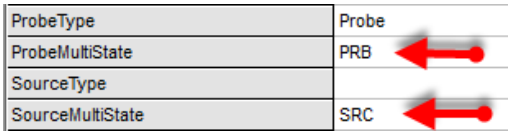
Also, the probe inputs must have their Type object's "SubType" property set for A or B.



Analyzing with dual-use probe/source lines

Although most CPC systems operate on autoclaves and ovens where the probe line is different than the source line, there are some systems where each line is capable of dual purpose operation. In these systems, each vacuum line can be configured by the operator to be either a source or a probe.

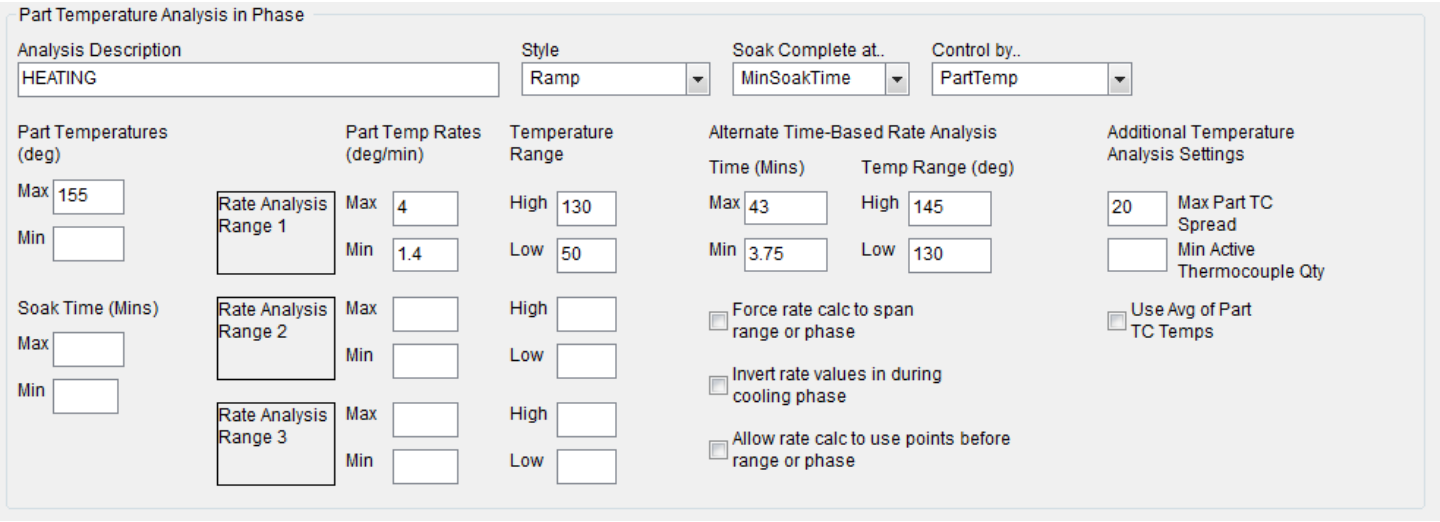
In these systems, the DataAnalyze object must be configured to distinguish between vacuum readings that are on a probe-configured line and vacuum readings that are on source-configured lines. The ProbeMultiState and SourceMultiState entries are used for this purpose.



These entries are compared to the "MultiState" entry for each probe's part attachment.

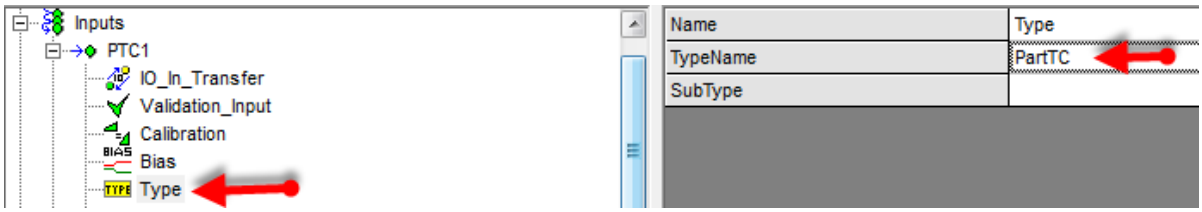
Part Temperature analysis section

This section is used to analyze part temperatures (ie. PTC) and other cure temperatures that are used in place of part thermocouples during the phase.



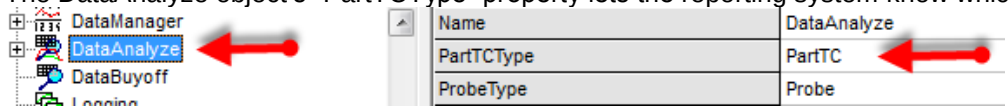
How does the card recognize part temperature data?

The input names for part temperatures can be different from system to system. ASC's general rule is to name these with the prefix PTC, however some customers use TC, TE, or other prefixes. In order to provide a recognizable classification of these inputs, a "Type" object is placed under each part temperature input and its TypeName property is defined the same for each input. The TypeName used for part temperature inputs is usually "PartTC".



When the data is saved during a run, the datafile includes an InputNames record which includes the name of the input, the units, and the TypeName of the input. It is this record's information that instructs the card to which input is a part thermocouple.

The DataAnalyze object's "PartTCType" property lets the reporting system know which typename to look for.

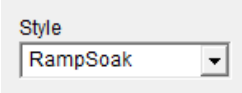


Part or Batch analysis

Part temperature inputs are typically enabled and saved only if they are attached to a part during run setup. As such, the set temperature readings analyzed by the quality card will change depending on whether you are interested in generating a "Batch" quality report or an an "All Parts" quality report.

In the case of the Batch report, all part temperatures in the run will be analyzed together. In the case of the All Parts report, only those part temperature readings associated with the part will be analyzed. This will result in different analysis results for each processed part.

Temperature analysis styles



There are four analysis styles available:

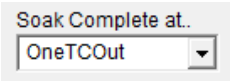
Hold – this is used to analyze the temperature of each part sensor at a fixed temperature setpoint.

Ramp – this is used to analyze the ramp rate and temperatures of each part sensor during the ramp.

Ramp/Soak – this analysis links the ramp and the soak into one analysis section. The system will track each part temperature individually and analyze the rate, the temperature min/max during soak, and the min/max soak times. Soak time is calculated as the total amount of time spend between the Min Temperature and the Max Temperature, regardless of the phase end time.

Soak Analysis – this is a special soak analysis that shows statistics on each part temperature. This analysis does not follow the typical phase-start and phase-end times and analyzes the run based on a single ramp and soak cure cycle. This report was requested by a specific customer and might not be suitable to your specific cure cycle.

"Soak Complete At" setting



Because the "RampSoak" style continues to analyze the part temperatures independent of the phase end time, it is often useful to determine what "SoakComplete" really is. Once defined, the SoakComplete flag can be used to trigger a change of phase (sequential) or an end of phase (parallel).

The following selections are only used for "RampSoak" style analysis:

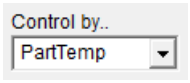
MinSoakTime – this option will set the SoakComplete flag when all part temperatures have achieved the minimum soak time.

OneTCOut – this option sets the SoakComplete flag when the minimum soak time has been achieved by all active part temperatures AND when one temperatures drop (or rise) out of the Min/Max temperature band.

AllTCsOut – this option sets the SoakComplete flag when the minimum soak time has been achieved by all active part temperatures AND when all temperatures drop (or rise) out of the Min/Max temperature band.

*** Note: by making a selection, you will not be changing the analysis of maximum soak time. The maximum soak time will still be based on the total time that each part temperature is inside the band, regardless of definition of soak complete and phase end/change.*

"Control By" setting



Some customers have specifically asked that the system not analyze each part temperature, but rather analyze a different subset of temperature data. This entry is used for that purpose. Here are the selections:

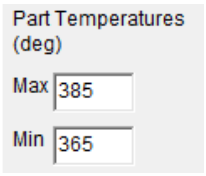
PartTemp – this is the default selection and instructs the system to evaluate and analyze all active part temperatures.

AirTemp - this setting instructs the system to analyze the Air temperature as if it were a part thermocouple. No individual part temperatures will be analyzed.

HITC only - this setting instructs the system to analyze the highest enabled part temperature as if it is a single part temperature sensor. No other individual part temperatures will be analyzed.

LOTC only - this setting instructs the system to analyze the lowest enabled part temperature as if it is a single part temperature sensor. No other individual part temperatures will be analyzed.

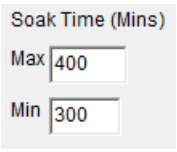
Part Temperature Min and Max



For “Hold” style: these temperatures are used to define the Min and Max limits. If you leave an entry blank, that analysis will not occur

For “Ramp” style: The analysis occurs throughout the phase. If ramping up, then you should only use the Max setting to avoid a finding on low temperature. If ramping down, you should only use the Min setting.

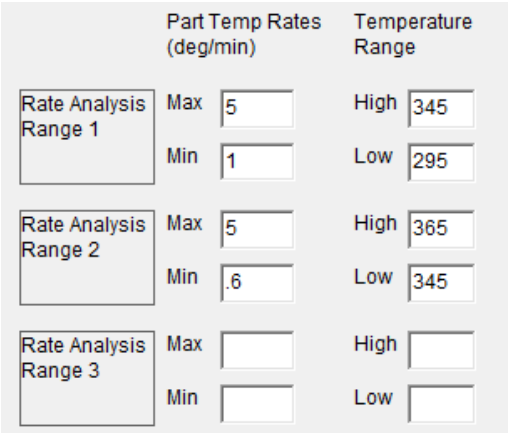
Soak time analysis



This option is only used by “RampSoak” and “SoakAnalysis” styles. When entered, the system will calculate the soak times for each individual part temperature. The soak time will be incremented by one time interval for each temperature data point that is inside the Min/Max temperature band.

The soak time is calculated independently of the end of the phase. This means that the soak time does not stop when the phase ends.

Rate analysis with ranges



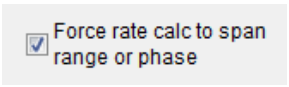
The system will calculate up to three Min/Max rate groups within the phase. Each group can be targeted to a specific temperature range, in which case only those values between the ranges will be used for rate calculations. This is common in composite applications where the minimum rate requirement changes as the temperatures approach the soak temperature.

When using different Min/Max sets, the report will include statistics and pass/fail indication at each of the ranges.

If you don’t include a range, the analysis will occur throughout the entire phase.

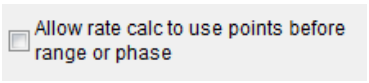
Important: if the specific Rate Calc Interval is larger than the number of valid data points in the specified range, the system will reduce the rate-calc interval to a value that will allow a rate calculation to occur. A message will notify you of this change in the interval.

Switch to “spanning” rate method



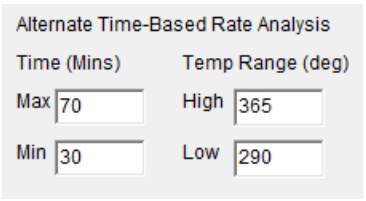
By clicking the “Force rate calc to span range or phase”, you will instruct the system to calculate each sensor’s rate with a single calculation based on the first value within range and the last value within range. This will result in single 2-point calculation for each sensor. When this option is selected, the interval-based calculation will be disabled for the phase.

Allow rates to calculate from data before phase or range



The normal rate calculations only use data points inside the current phase or range. This means that if your ratecalcinterval is 5, then the system will not calculate rates for the first 5 intervals inside a range or phase because the data points 5 intervals in the past would be outside of the range/phase. By clicking the “Allow rate calc to use points before range or phase”, you will instruct the system to use data intervals outside of the current range or phase for lookback calculated rates. This will allow the rate calculations to begin on the very first interval inside the phase/range.

Alternate time-based rate analysis

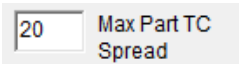


In this analysis, the system will not use rates of change but rather minimum and maximum time to get from one temperature to another. This is a legacy analysis used by only a few CPC users. ASC recommends using the standard ramp rate entries.

This type of analysis is only valid with the “Ramp” style.

Max Part TC Spread

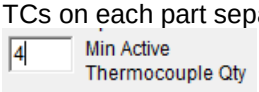
You can set a maximum temperature spread for the phase. This provides a similar report output as the card’s spread analysis.



The report output will be:

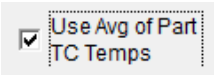
Min Active Thermocouple Qty

You can also have the system check the quantity of active thermocouples in the phase. This check will be different depending on what type of report you are generating. For the Quality Batch report, the system will anayze all part thermocouples in the batch. For the Quality Individual Part and Exceptions Report, the system will analyze and count TCs on each part separately.



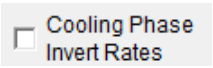
Use Avg of Part TC Temps

You can also have the system analyze only the average temperature of all part temperatures. In this way, individual part temperatures will not be analyzed.



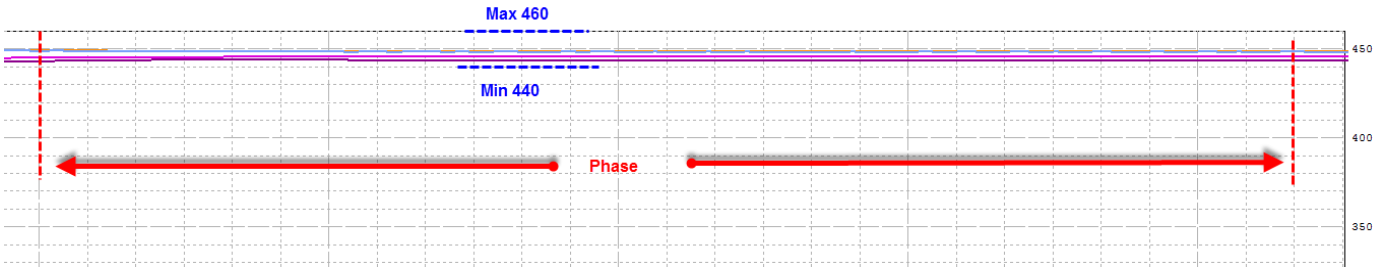
Cooling Phase Invert Rates

You can also have the system invert the rates during a cooling segment. This option is rarely used and only if you want rates during cooling to be shown as a postive value.

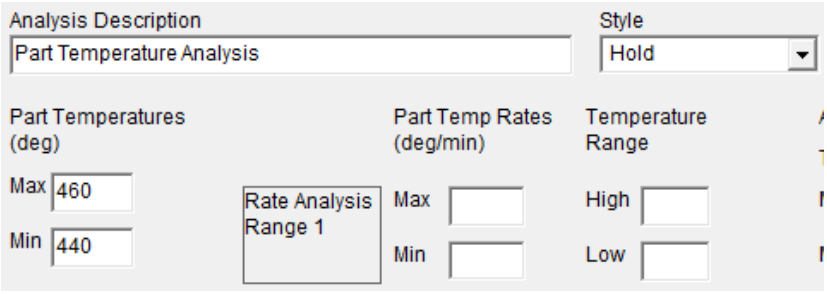


Example: Hold style

Here is a phase that spans a temperature hold at 450F.



Here's the setup:

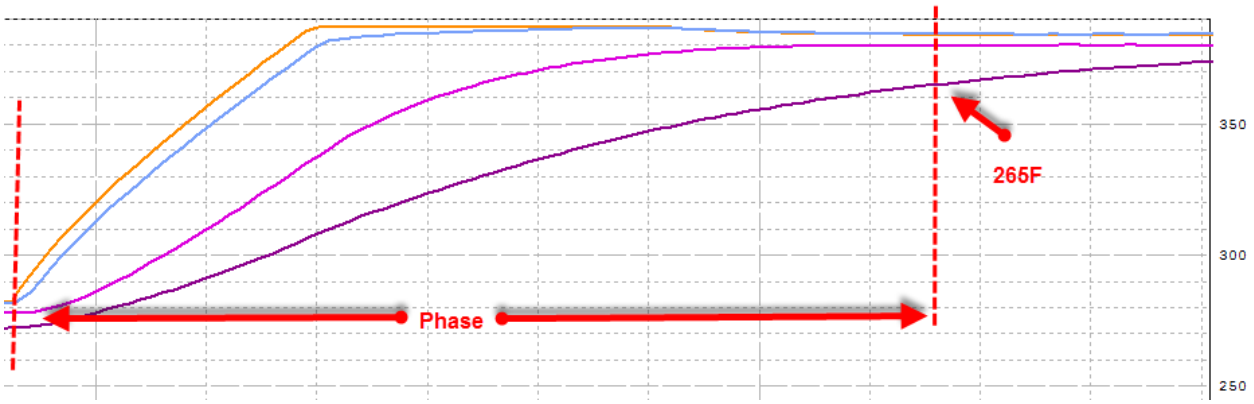


Here's the output:

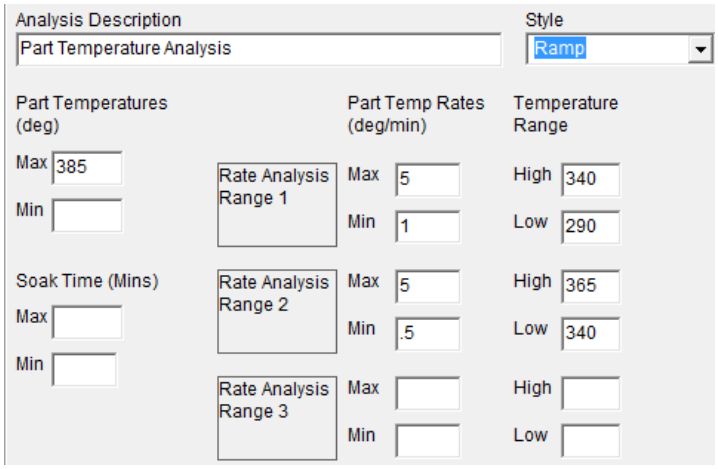
Part Temperature Analysis
Max Temp = 445.8 Deg. From PTC3 at 1002.03 mins. (Req: 460.0 Deg.)
Min Temp = 442.9 Deg. From PTC1 at 840.03 mins. (Req: 440.0 Deg.)

Example: Ramp style

Here is a phase that spans the heating from 280F to 380F at 5F/min.



Because we are only interested in analyzing the ramp, we will only enter rate information and max temperature. All other entries are blank.

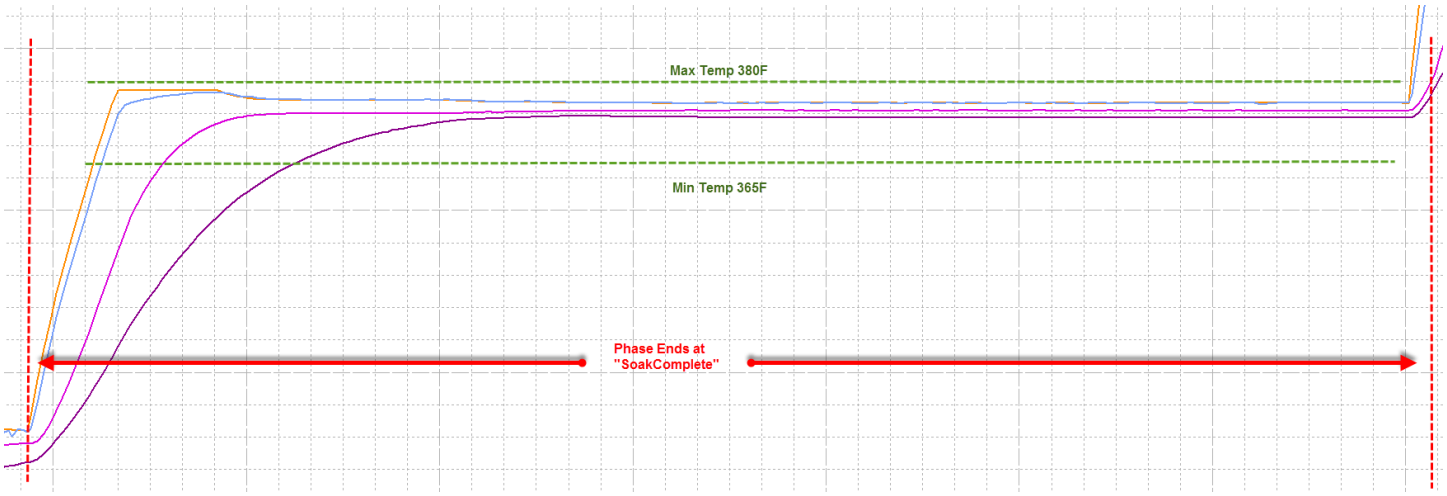


Here's the report output

Part Temperature Analysis	
Max Temp Rate from 290 to 340 Degs = 2.84 Deg/Min From PTC6 at 320.03 mins.	(Req: 5.00 Deg/Min)
Min Temp Rate from 290 to 340 Degs = 1.20 Deg/Min From PTC2 at 342.03 mins.	(Req: 1.00 Deg/Min)
Max Temp Rate from 340 to 365 Degs = 2.31 Deg/Min From PTC6 at 326.03 mins.	(Req: 5.00 Deg/Min)
Min Temp Rate from 340 to 365 Degs = 0.50 Deg/Min From PTC1 at 366.02 mins.	(Req: 0.50 Deg/Min)
Max Temp = 380.0 Deg. From PTC6 at 375.03 mins.	(Req: 385.0 Deg.)

Example: Ramp/Soak

Ramp from 280F to 380 +5/-10. SoakComplete when OneTCOut.



Here's are the settings:

Analysis Description: Part Temperature Analysis
Style: RampSoak
Soak Complete at..: OneTCOut
Control by..: PartTemp

Part Temperatures (deg)		Part Temp Rates (deg/min)		Temperature Range		Alternate Time-Based Rate Analysis	
						Time (Mins)	Temp Range (deg)
Max 385	Rate Analysis Range 1	Max 5		High 340		Max	High
Min 365		Min 1		Low 290		Min	Low
Soak Time (Mins)	Rate Analysis Range 2	Max 5		High 365			
Max 400		Min .5		Low 340			
Min 300	Rate Analysis Range 3	Max		High			
		Min		Low			

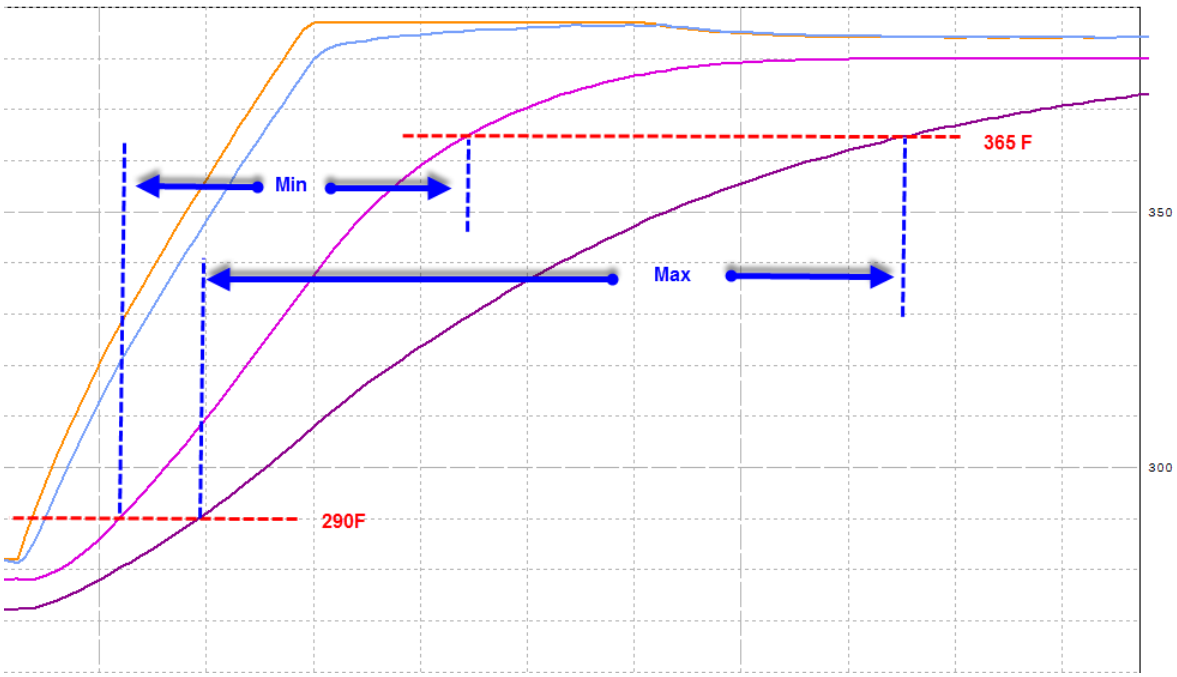
Here's the report output:

Part Temperature Analysis

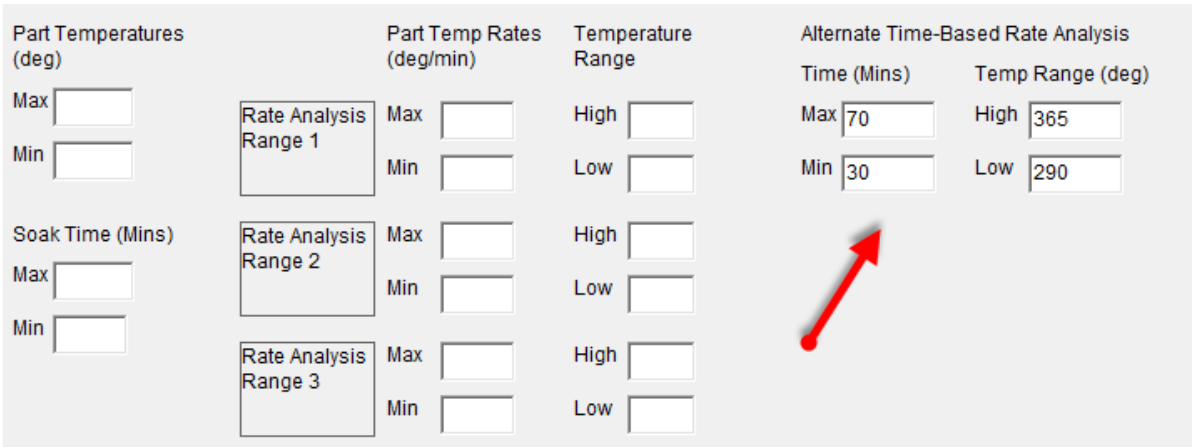
Max Temp Rate from 290 to 340 Degs = 2.84 Deg/Min From PTC6 at 320.03 mins.	(Req: 5.00 Deg/Min)
Min Temp Rate from 290 to 340 Degs = 1.20 Deg/Min From PTC2 at 342.03 mins.	(Req: 1.00 Deg/Min)
Max Temp Rate from 340 to 365 Degs = 2.31 Deg/Min From PTC6 at 326.03 mins.	(Req: 5.00 Deg/Min)
Min Temp Rate from 340 to 365 Degs = 0.50 Deg/Min From PTC1 at 366.02 mins.	(Req: 0.50 Deg/Min)
Max Temp = 380.9 Deg. From PTC3 at 516.03 mins.	(Req: 385.0 Deg.)
Min Temp = 365.0 Deg. From PTC2 at 375.85 mins.	(Req: 365.0 Deg.)
Min Soak Time = 350.18 Mins From PTC2	(Req: 300.0 Mins)
Max Soak Time = 391.00 Mins From PTC6	(Req: 400.0 Mins)

Example: Time-based ramp analysis

The following settings expect the parts to heat from 290F to 365F in 30-80 minutes.



The settings define the specific temperature rate and the min/max times:

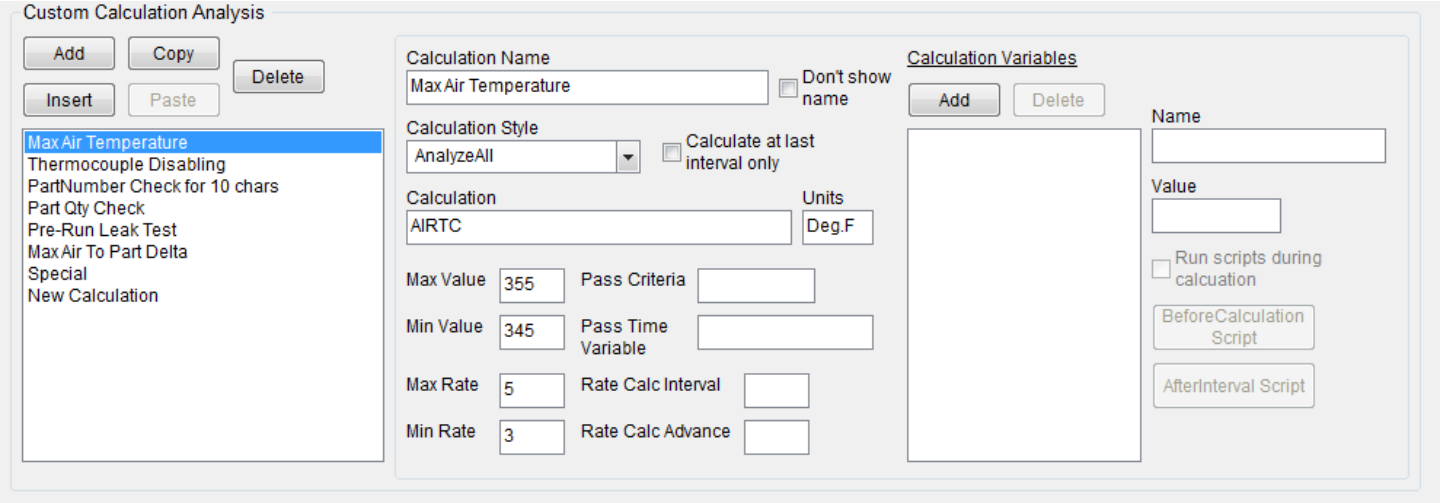


Here's the report output:

Part Temperature Analysis
Max Ramp Time from 290 to 365 Degs = 66.00 Mins From PTC2 (Req: 70.0 Mins)
Min Ramp Time from 290 to 365 Degs = 32.98 Mins From PTC6 (Req: 30.0 Mins)

Custom calculation analysis

Although the standard analysis sections cover many of the analysis requirements of composite specifications for curing in autoclaves and ovens, there are some analysis requirements that require a more targeted and custom analysis approach. For these requirements, we have created the Custom Calculation Analysis section of the quality card.



What is a calculation?

A calculation is a customizable inspection element that can be added to a specific phase analysis. Each calculation added to a phase will result in a report entry and quality Pass/Fail finding. There are many versions of reporting output available, including custom output text.

What can be analyzed

The custom calculation section is designed to provide maximum flexibility for your analysis. Each calculation can analyze virtually any type of data saved to the datafile, as well as external information can be used in the analysis. This includes the following:

Any input value - You can directly analyze the value of any input saved to the datafile.

Part information - You can analyze any entry in the part information, including part attachment information and pre-run leak test results. This information can be used for comparisons, database searches, or direct analysis.

Run Messages - You can analyze every run messages, including alarms, and determine findings based on the message contents.

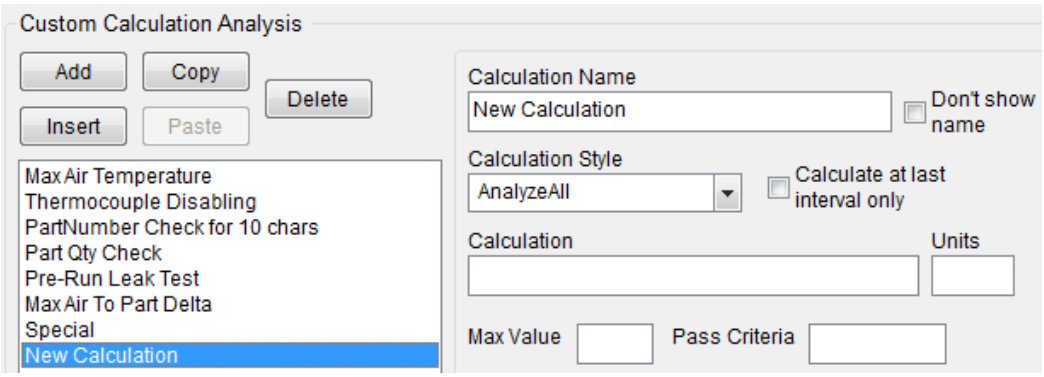
Recipes - You can inspect and analyze recipe information and use it for analysis of other items. The information can include recipe name, revision, and specific recipe entries.

Variables - You can inspect and analyze run variables stored to the datafile. This capability not only works for the standard “Variables” record, but any other variable set stored to the datafile.

Calculations - You can perform mathematical calculations on inputs and analyze the results with Min/Max and Pass/Fail

Scripting - You can perform detailed interval by interval evaluation, manipulation, and analysis of run data using custom scripting.

How to add a calculation



Add

Click the button to add a new calculation element to the current phase. This will add a new calculation with the name "New Calculation", and it will be placed immediately after the currently selected list item. Once added, you should rename the calculation with a descriptive name (ie. Max Pressure Deviation).

Insert

This will add a calculation before the currently selected calculation on the list.

Delete

Use the Delete button to delete the currently selected calculation element.

Copy / Paste

You can select a calculation and click the "Copy" button to copy it to the clipboard. Then, you can paste that copied calculation to the same phase or to a different phase.

Calculation name

The calculation name identifies the calculation. The name will be displayed on the report immediately above the analysis determination.

In cases where you want custom report output using the ResultDisplay (see scripting section later in manual), you can suppress the calculation name on the report by checking the "Don't show name" option.

Calculation styles

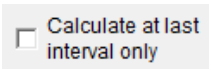
Calculations can be setup to analyze all data records in the phase, or can be instructed to only analyze the first or last data record. Here are the options:

AnalyzeAll - Step through the phase and analyze each data record.

AnalyzeFirst - Only analyze the first data record of the phase. This is used in situations where you want to analyze non-interval data such as part information, messages, or scripting results. This shortens the analysis overhead by only scanning one data record.

AnalyzeLast - Only analyze the last data record of the phase. This is used for situations where you want to analyze a single value at the end of the phase. This is useful if you want to verify that a specific condition was met in the phase.

Calculate at last interval



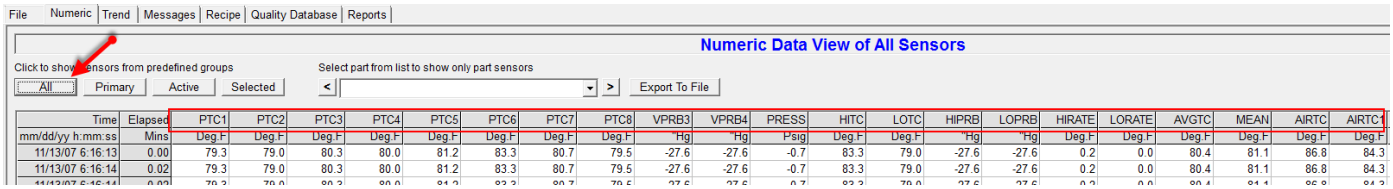
This check-box is used with the AnalyzeAll style setting. Select this option when you want to step through each record in the phase, but only perform the Min/Max or Pass/Fail calculations at the last interval. This is used primarily when the target of the calculation is a custom variable and scripts are used to set that variable.

Calculation entry

The calculation is the element, mathematical calculation, or statistical result that you want to inspect and analyze. The units are entered for the report output purposes.

Individual input name

You can analyze any input saved to the datafile. This includes all inputs available on the numeric view.



For example, if you're interested in evaluating the value of PTC1, just type PTC1 in the calculation.

Mathematical calculations

You can enter a calculation using multiple inputs.

The following mathematical operators and functions are provided:

+	Addition
-	Subtraction (*must be separated by spaces to avoid confusion with negative values*)
*	Multiplication
/	Division
^	Exponent
SQR	Square root function (ie. SQR(PTC1))
ABS	Absolute function (ie. ABS(PTC1))

Logical operators

You can use the following comparison operators to determine True or False results.

>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to
<>	Not equal to
=	Equal to
AND	Logical AND (ie. PTC1>100 AND AIRTC<200)

OR Logical OR (ie. PRESS>20 OR PSET=100)

Reserved elements

The following reserved elements are preconfigured in the system.

TimeInPhase This is the specific elapsed phase time during the interval-by-interval analysis through the phase. *Note: You can also use "PhaseTime" for the same results..*

Statistical results of groups of sensors

You can analyze High, Low, Average, and Midpoint of groups of thermocouples, vacuum probes, or other sensor sets.

Any input that has a "Type" object below it can be grouped and provide group statistical analysis. Normally, part thermocouples are grouped by Typename = "PartTC" and vacuum probes are grouped with Typename = "Probe".

Here are some common examples that can be used in the Calculation:

High(PartTC) For each data record, this identifies the highest reading of enabled inputs designated with Typename= PartTC. This usually includes all part thermocouples in the batch (Batch Report) or only the thermocouples on each part (All Parts report). Note: you can also use Max(PartTC) or MaxPartTemp to provide the same results.

Low(PartTC) For each data record, this identifies the lowest reading of enabled inputs designated with Typename= PartTC. This usually includes all part thermocouples in the batch (Batch Report) or only the thermocouples on each part (All Parts report). *Note: you can also use Min(PartTC) or MinPartTemp to provide the same results.*

Avg(PartTC) For each data record, this identifies the average reading of enabled inputs designated with Typename= PartTC.

Mid(PartTC) For each data record, this identifies the midpoint between High and Low of enabled inputs designated with Typename= PartTC.

Spread(PartTC) For each data record, this identifies the spread between High and Low of enabled inputs designated with Typename= PartTC.

High(Probe) For each data record, this identifies the highest reading of enabled inputs designated with Typename= Probe. *Note: you can also use Max(PartTC) or MaxPartTemp to provide the same results.*

Low(Probe) For each data record, this identifies the lowest reading of enabled inputs designated with Typename= Probe. *Note: you can also use Min(PartTC) or MinPartTemp to provide the same results.*

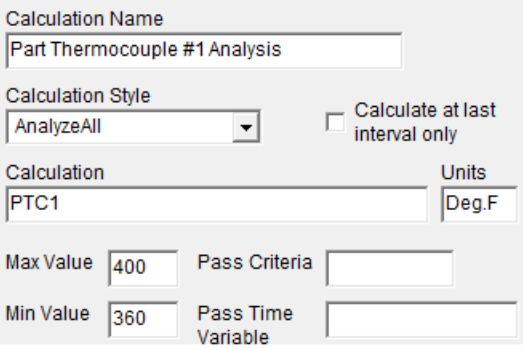
Avg(Probe) For each data record, this identifies the average reading of enabled inputs designated with Typename= Probe.

Mid(Probe) For each data record, this identifies the midpoint between High and Low of enabled inputs designated with Typename= Probe.

Spread(Probe) For each data record, this identifies the spread between High and Low of enabled inputs designated with Typename= Probe.

Min and Max value check

The entry of a Min or Max value will intiate a check on the minimum and maximum value through the phase (AnalyzeAll) or at the beginning (AnalyzeFirst) or end (AnalyzeLast) of the phase. Here's an example where we analyze a specific thermocouple.



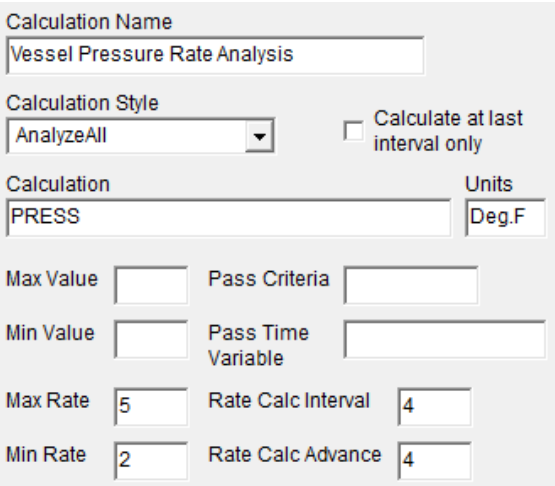
The resultant output would be this. You will see that the calculation name is shown, but the actual contents of the Calculation field are not. This is intentional in order to avoid confusion.

```
    Part Thermocouple #1 Analysis
    Max Value = 225.0 Deg.F at 163.03 mins.          (Req: 400.0 Deg.F)
*** Min Value = 83.8 Deg.F at 14.03 mins.            (Req: 360.0 Deg.F)
```

Min Rate and Max Rate check

The entry of a Min Rate or Max Rate will intiate a check of the rate of the value represented by the Calculation entry. The rate will be calculated using the card's Rate Calc Interval and Advance, or you can select a custom Rate Calc Interval and advance for this individual calculation.

Here's the setup using a custom Rate Calc Interval and Advance:



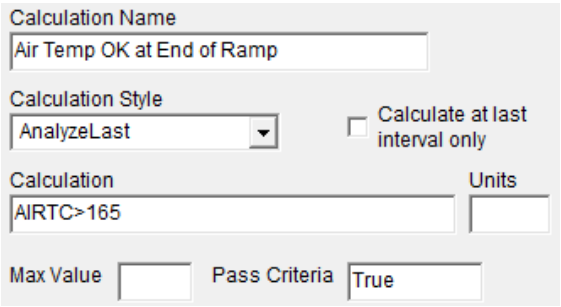
The resultant output would be this.

```
    Vessel Pressure Rate Analysis
*** Max Rate = 5.1 Deg.F/min at 292.03 mins.      (Req: 5.00 Deg.F/min)
    Min Rate = 5.1 Deg.F/min at 291.03 mins.      (Req: 2.00 Deg.F/min)
```

Pass/Fail using the normal calculation

If you're not interested in Min or Max evaluation, you can also enter a logical comparison and use the "Pass Criteria" as a pass/fail indication.

Here's the setup. You can see that we're only analyzing the last data point in the phase and are checking that air temperature is greather than 165. Units are not required because the result is a True or False value:

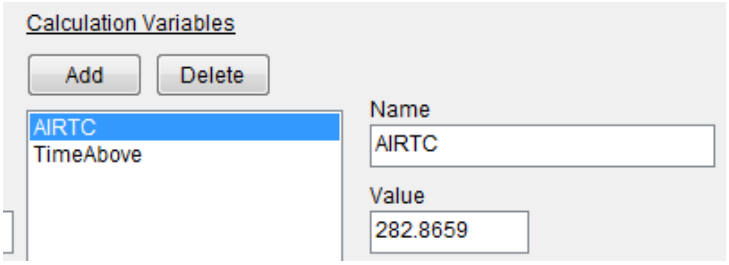


Here's the report output. You can see that, unlike Min/Max evaluations, the system will include the Calculation (ie. AIRTC>165) in the response and indicate the True or False result of the comparison. The word "Pass" or "Fail" will be displayed on the report.

Using custom variables & scripting

For analysis that is not a simple comparison of input values, the quality card includes a powerful set of features that allow you to expose input values, expose run variables, parse other run data, and create custom analysis with scripting.

Custom variables



Custom variables are used to either expose run data for scripting and to provide a result value to be used for the standard Min/Max or Pass/Fail evaluation.

You can add a variable and give it a name. Once named, the system will determine whether the variable is an input name, datafile variable, or a local variable to be used in scripting.

Here are the naming options:

Input Name	If the variable is the same name as an input name (ie. AIRTC), then the variable will be set to the interval data value during the interval analysis. To use this in scripting, use the object value: Me.InputName\Value
MaxPartTemp	This reserved keyword will expose the highest part temperature in the interval. This will work on Batch and Individual part analysis. To use this in scripting, use the object value: Me.MaxPartTemp\Value
MinPartTemp	This reserved keyword will expose the lowest part temperature in the interval. This will work on Batch and Individual part analysis.

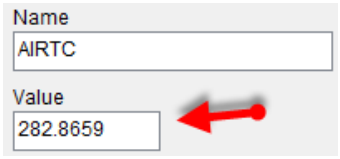
To use this in scripting, use the object value: Me.MinPartTemp\Value

MaxProbe	This reserved keyword will expose the highest vacuum probe reading in the interval. This will work on Batch and Individual part analysis. To use this in scripting, use the object value: Me.MinProbe\Value
MinProbe	This reserved keyword will expose the lowest vacuum probe reading in the interval. This will work on Batch and Individual part analysis. To use this in scripting, use the object value: Me.MinProbe\Value
Variables:Name	If you have a colon in the name, the system will expose the specific value from the saved Variables object or any other object that is saving Variable values. For example, "Variables:OperatorName" will expose the operator name value to the scripting or analysis. *To use this variable in script, use the object value: Me.Variables:OperatorName\Value*
Local variable	If the name is not an input, then a local variable will be created. This variable can be used in scripting and can also be used in the Calculation textbox for analysis. Normally, this is used for a pass/fail value (ie. Result) or a script-calculated value (ie. CalcValue). *To use this variable in script, use the object value: Me.VarName\Value*

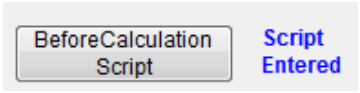
When are custom variables updated

In cases where variables are named as input names (ie. PRESS, AIRTC, PTC1, etc.), when the Calculation analysis steps interval by interval, it will set the value of the variable(s) to the same value as the specific run data. These values can then be used directly within the AfterInterval script.

If a variable is updated by the system or by scripting, the final value will be displayed in the "Value" property.



BeforeCalculation script

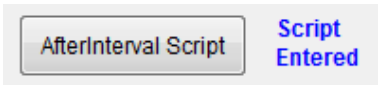


This script is useful in initializing variables prior to the interval analysis, or it can be used as a standalone script for analysis that involve Databuyoff parsing.

This script is triggered immediately before the calculation analysis is started.

AfterInterval script

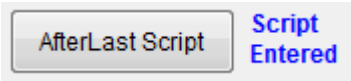
This script is triggered each time the Calculation analysis steps through a specific interval and has updated the exposed variables. The script is used for custom analysis of run data and to create custom results and report displays.



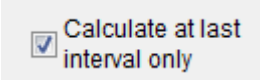
Note that while the analysis functions are all performed by the CPC Client application, the script running occurs at the CPC Server application. This means that analysis using the AfterInterval script will take longer to analyze than a simple comparison. For example, you can expect that, for a 1000 interval datafile, the calculation analysis using a script will take 2-3 seconds. This is 100 times slower than a normal calculation analysis.

AfterLast script

This script is triggered once after all intervals have been calculated, but before the system evaluates the ResultDisplay or the final Calculation. This script is therefore used to finalize the calculation variables, ResultDisplay, and pass variable after the AfterInterval scripts have all completed.



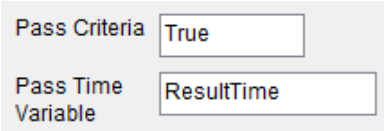
Holding the calculation to the last interval



This forces the calculation to occur only after the last interval is anlyzed. When using scripting to perform interval analysis, you will often want the final calculation's Min/Max or Pass/Fail determination to occur only after the last interval is analyzed and the last script is run. This will speed up the analysis because the system won't be checking min/max and pass/fail during the interval-by-interval proces.

Using Pass Time Variable to expose the runtime

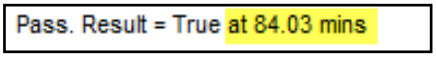
When you use scripting to analyze the data and determine a result value, you will often want to also display the elapsed runtime at which point the result became true.



The Pass Time Variable tells the system which variable it should use to show the time of the result. This time value will be shown on the report. The script would use the Me\Runtime property to load the variable:

```
Me.ResultTime\Value = Me\RunTime
```

Here's the output of the report showing the ResultTime:



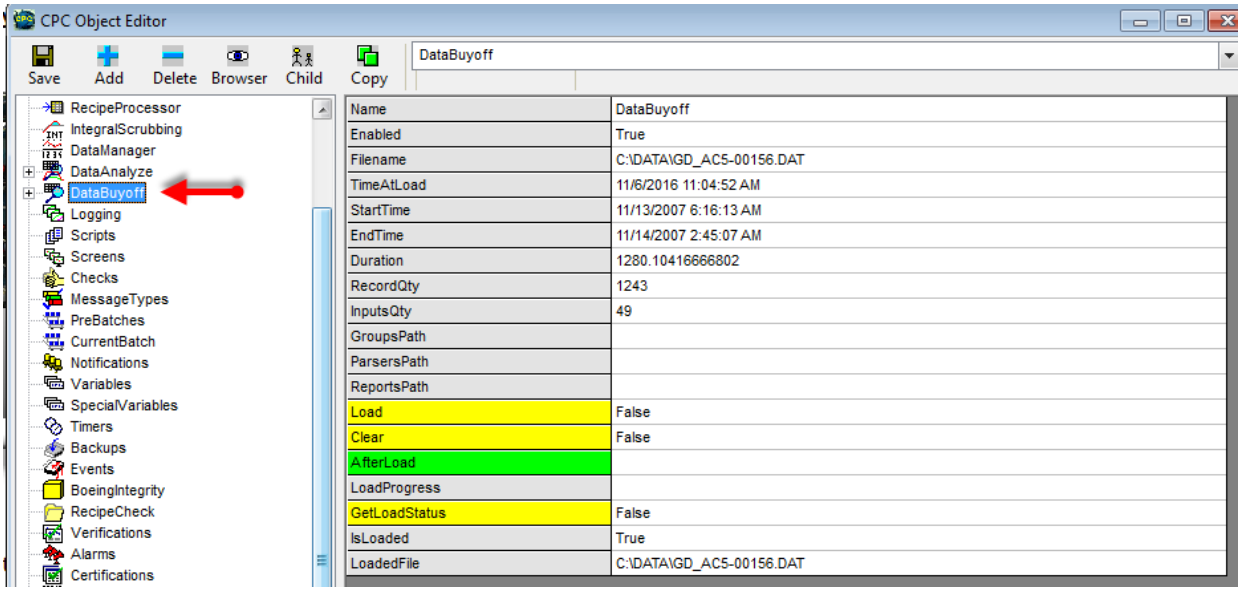
Using Databuyoff object and parsing

In cases where you want to expose other types of run information, you will have to couple a Databuyoff object with the DataAnalyze object in CPC. Once coupled, you can use the DatabuyoffParsing objects to step through different types of run data other than the normal input values.

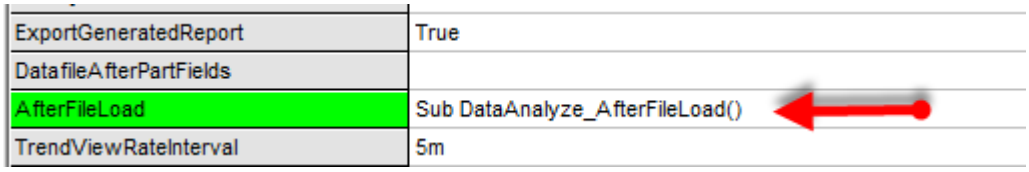
How to setup Databuyoff capability

This is handled in the ObjectEditor by qualified personnel. You will want to add a DataBuyoff object and make a change to the DataAnalyze AfterLoad script.

Add a DataBuyoff object to your configuration. Place it on the same level as DataAnalyze



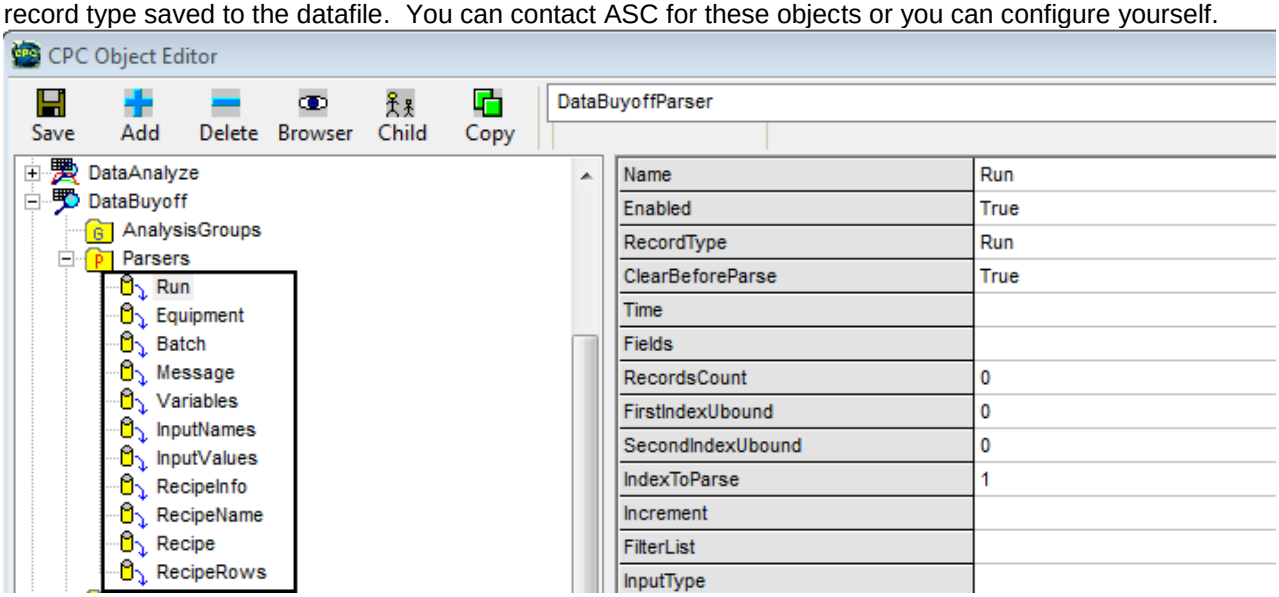
Change the AfterLoad script for the DataAnalyze object so that on the load of a file, the data buyoff will load the file into memory.



Here's the script. It sets the filename of the databuyoff and performs a load:

```
Sub DataAnalyze_AfterFileLoad()

   .Autoclave.DataBuyoff\Filename = Me\File
   .Autoclave.DataBuyoff\Load


EndSub
```

Add a DataBuyoffParsers object to the databuyoff, and then add individual DataBuyoffParser objects for each data record type saved to the datafile. You can contact ASC for these objects or you can configure yourself.



Each parser is configured for a specific datafile record type.

What records can be parsed?

Parsing is used to analyze individual data record in the datafile. Here are the types of records you can scan and analyze using the parsing object:

Equipment	Equipment name information
Batch	Part information, including part attachments
Message	Run messages, including alarms
Variables	Run variables
InputNames	List of input names, input types, and units
InputValues	Scan each data interval and analyze direct data. The InputValues are the same values as is normally analyzed with quality cards.
RecipeInfo	
RecipeName	
Recipe	Expose the recipe contents for analysis.
RecipeRows	Expose the row names of the recipe.

How a DataBuyoffParser works

The parser object is used to assemble data records of a specific type and display information for each record. When a parser parses the record, it will create child objects that will hold the exposed information.

Name	Message
Enabled	True
RecordType	Message
ClearBeforeParse	False
Time	11/3/2016 3:02:58 PM
Fields	Time,Text,Type,Equipment,Part,Tagname,Setting,Criterion,Value
RecordsCount	91
FirstIndexUbound	
SecondIndexUbound	
IndexToParse	11
Increment	
FilterList	
InputType	
PartIndex	
IsSegmentChange	False
Parse	False
Next	False
Previous	False
Clear	False
AfterParse	
RateCalcInterval	

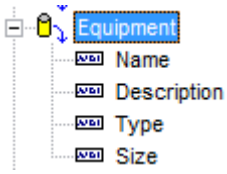
Here are the properties, methods, and quick-scripts for the parser object:

RecordType	This is the data record type to expose. These are the same as what is defined in the DataSaving object.
ClearBeforeParse	This instructs the system to clear the children object before parsing the first record (IndexToParse = 1). This is set to True for record types whose contents will change from run to run. *Note: When setting a parser to ClearBeforeParse, any script that analyzes the children cannot use a direct object path method but must instead use the GetChildProp function.*
Time	Time the specific record was saved.
Fields	List of data fields included in the record.
RecordsCount	Number off distinct records in the datafile of this record type. For InputValues - # of data records For Batch - # of parts For Message - # of messages For Recipe - # of saved recipes
FirstIndexUbound	For InputValues - # of inputs saved per data record For Batch - # of part fields (excludes LeakReq, LeakAmount, and BatchTool)
SecondIndexUbound	For Batch - # of attachments for the specific part IndexToParse. For Variables - # of variables
IndexToParse	Identifies and/or targets a specific record. This is used for Batch, Messages, Recipes, and other record types where RecordsCount > 0.
Increment	Used to jump more than one interval at a time using the Next and Previous methods.

FilterList	Used for InputValues parsing. Can include a list of specific inputs that you want to expose.
InputType	Used for InputValues parsing. Will expose only the inputs associated with a specific Type (ie. PartTC).
PartIndex	Uased for InputValues parsing. Will expose only those inputs associated with the specific part index.
IsSegmentChange	For InputValues records, this is set to True when the record is a non-interval saved record. These records typically happen at segment changes.
Parse	Method used to parse and expose the record identified by IndexToParse.
Next	Method that will parse the next record. The method will increment the IndexToParse property by the value indicated in the Increment property. It will then parse that record.
Previous	Method that will parse the previous record. The method will decrement the IndexToParse property by the value indicated in the Increment property. It will then parse that record.
Clear	This method will clear the children prior to a parse.
AfterParse	Script that runs after a parse, next, or previous method is complete.
RateCalcInterval	Used to define the RateCalcInterval when the FilterList is requesting the Rate of an input.

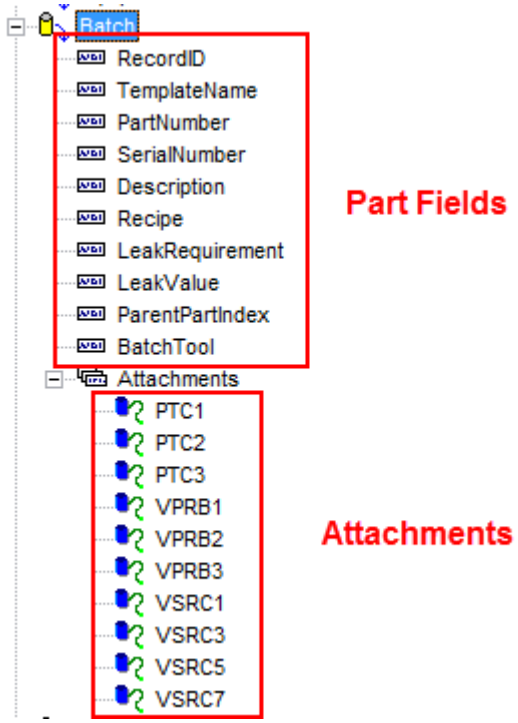
Equipment record type

The Equipment record includes the Name, Description, Type, and Size properties of the Equipment used to generate the datafile.



Batch record type

The Batch record includes the part information, pre-run leak information, and part attachment information.

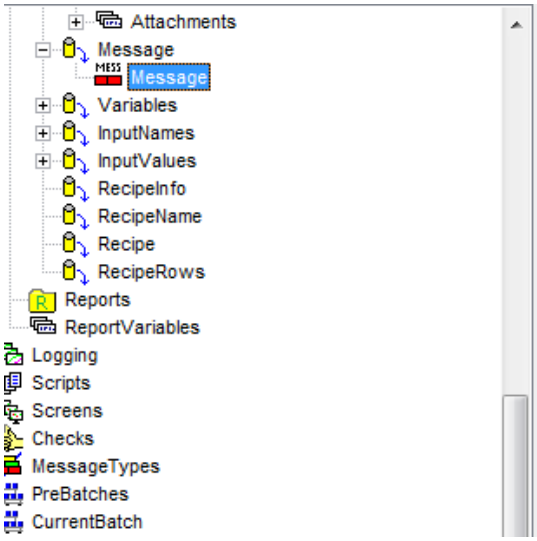


Each attachment includes the following properties:

Name	PTC1
Type	PartTC
BatchToolConnection	ToolAttach1

Message record type

This record type is used to expose the run messages and alarms. Only one message is exposed at a time, so you will need to use Next and Previous or IndexToParse to parse through the messages. Because the underlying object is the same for every message, you can set ClearBeforeParse = False.

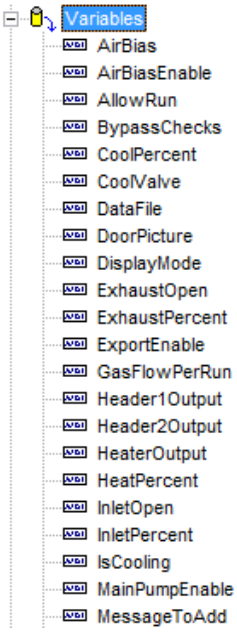


Name	Message
Time	7/8/2002 8:38:02 PM
Text	VENT BAG
Type	CureMessage
Equipment	Autoclave4
Part	
Tagname	
Setting	
Criterion	
Value	
Active	
Acknowledged	
ActiveTime	
AckTime	
AcknowledgedBy	
SourcePath	

For messages, the RecordCount property on the parser object displays the total number of messages. This count is used in the For-Next loop during scanning messages in scripting.

Variables record type

This record type is used to expose the Variables object that was saved to the datafile. This record type exposes a list of Variable children with a name and value. Normally, there will only be one record stored for Type = Variables, so a single parse will expose all variables.



Although the Variables associated with a given equipment will be constant, the variables for different equipment will be different and therefore you should use the “ClearBeforeParse” option. This also means that when accessing the children Variable values in scriping, you will want to use the function GetChildProp rather than using a direct object path.

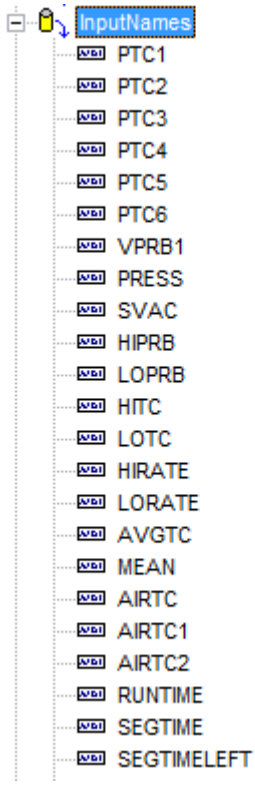
The variables below show an example set from an autoclave datafile. If you want to analyze specific information for a run, you can store that information in a variable and then use the Variables parser to expose the value:

InputNames record type

This record type stores the names of the saved inputs and the type and units for each.

The InputNames associated with a given equipment will be different for each run depending on the part attachments.. For this reason, the “ClearBeforeParse” option should be set to True. This also means that when accessing the children values in scriping, you will want to use the function GetChildProp rather than using a direct object path to the object.

Here’s an incomplete list:



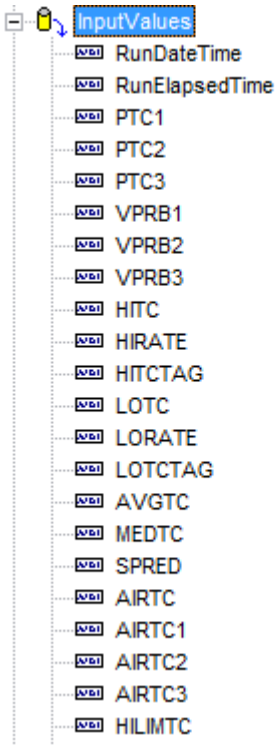
Each child will show the following properties:

Name	PTC1
Value	
Units	Deg.F
Enabled	
Type	PartTC
SubType	
Group	Thermocouples
GroupIndex	1
Part	

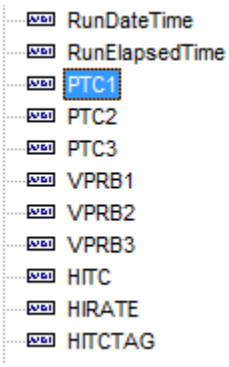
InputValues record type

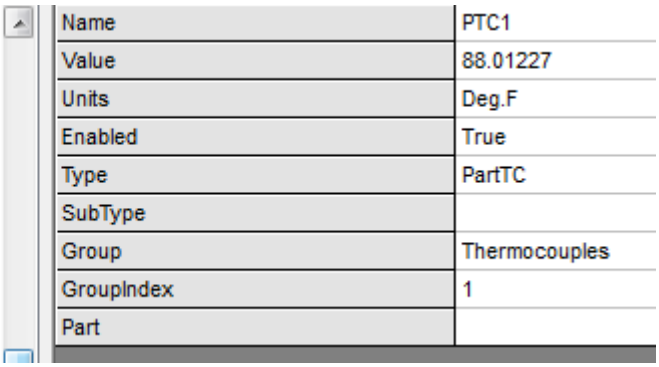
This record type is used to store the interval input data that is used for quality analysis and reporting. The parsing of this can be setup to parse all inputs to children objects or partial list of objects based on the FilterList property.

The parsing of a record will include the RunDateTime and the RunElapsedTime as children.



Each record will expose the name, value, units, enabled, type, group, and groupindex. If Enabled is False, this indicates that the input is disabled.





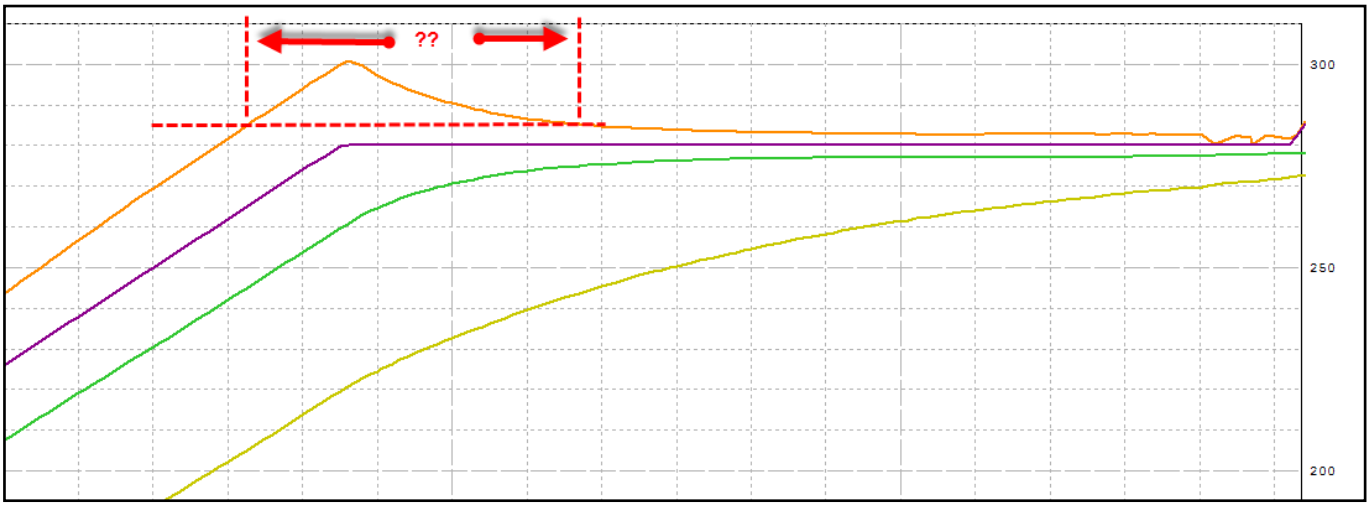
Name	PTC1
Value	88.01227
Units	Deg.F
Enabled	True
Type	PartTC
SubType	
Group	Thermocouples
GroupIndex	1
Part	

Calculation Examples

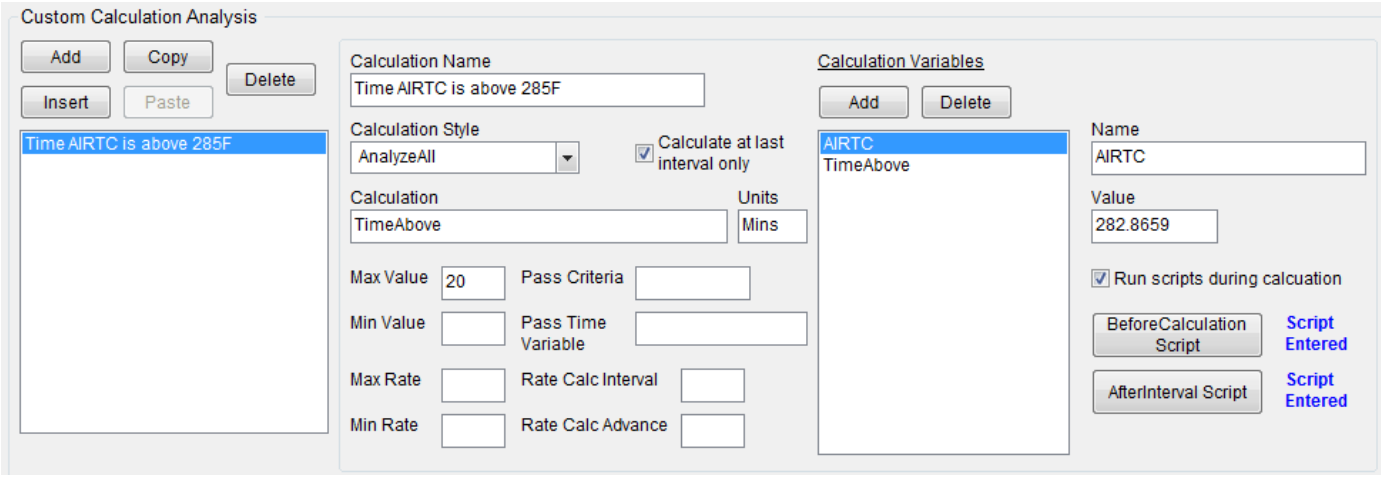
Calculate how long AIRTC exceeded 285 deg.F

Here's a simple analysis using variables and scripting.

We are interested in the amount of time during the heatup phase that AIRTC exceeded 285 F. This requires some calculation variables and scripting to determine the elapsed time.



Here's the setup. We define a variable to expose AIRTC to the script and we create a variable TimeAbove to hold the elapsed time:



Here's the BeforeCalculation script. This initializes the TimeAbove variable:

```
Sub Time AIRTC is above 285F_BeforeCalculation()

  Me.TimeAbove\Value = 0

EndSub
```

Here's the AfterInterval script. This determines whether AIRTC is greater than 285 and then increments the TotalTime by the current time interval between data points.

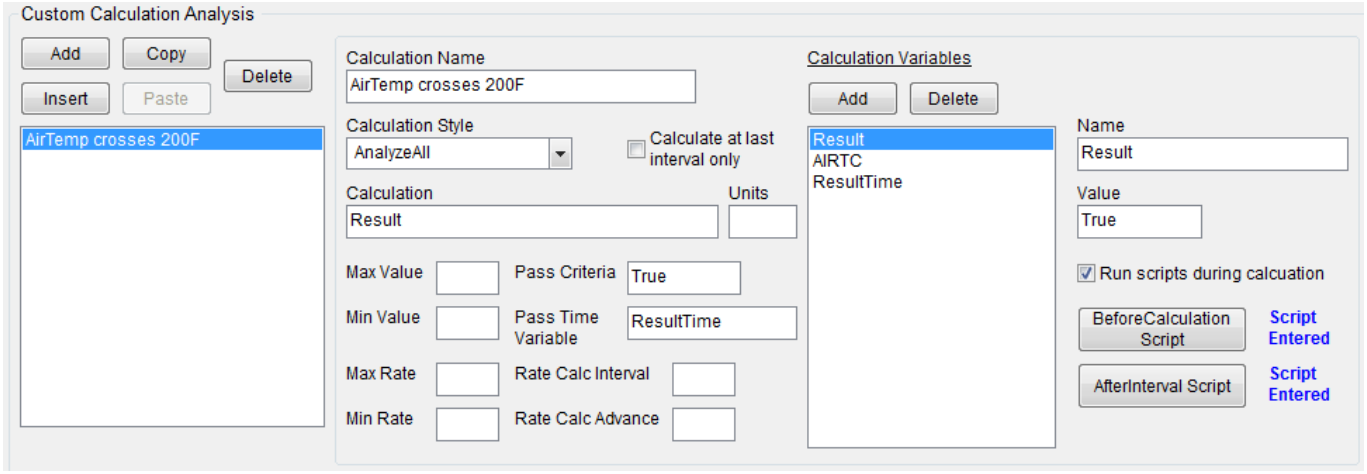
```
Sub Time AIRTC is above 285F_AfterInterval()


  ' ** check elapsed time that airtc > 285
  If Me.AIRTC\Value > 285 Then
    Me.TimeAbove\Value = Me.TimeAbove\Value + Me\TimeInterval
  EndIf


EndSub
```

Here's the output:

```
   Time AIRTC is above 285F
***Max Value = 46.0 Mins at 198.03 mins.                    (Req: 20.0 Mins)
```

Check whether and when AIRTC exceeded 200F

This example uses variables and scripting to determine if a specific condition occurred.



The calculation utilizes a pass/fail evaluation and uses a Pass Time Variable to display the run time at the true condition.

Variables used

Result	This variable will be set to True if AIRTC exceeds 200F.
AIRTC	This variable is used to expose the AIRTC input value so that it can be used in scripting.
ResultTime	This variable is used to display the time when the crossing occurs.

Here's the initialization in the BeforeCalculation script:

```
Sub AirTemp crosses 200F_BeforeCalculation()


  Me.Result\Value = Off


EndSub
```

Here's the interval script that runs after each interval:

```
Sub AirTemp crosses 200F_AfterInterval()

  ' ** determine when AIRTC is greater than 200
  If Me.AIRTC\Value > 200 And Me.Result\Value = Off Then
    Me.Result\Value = On
    Me.ResultTime\Value = Me\RunTime
  EndIf

EndSub
```

Here's the report output:

```
AirTemp crosses 200F
Pass. Result = True at 84.03 mins                                    (Req: True )
```

As an alternate, you can use the ResultDisplay property of the Calculation object to display a customer message for the pass and fail conditions.

This would be the BeforeCalculation initialization script. This is where we would create the default fail message.

```
Sub AirTemp crosses 200F_BeforeCalculation()


  Me.Result\Value = Off
  Me\ResultDisplay = "FAIL. Air Temperature never crossed 200F"



EndSub
```

This would be the AfterInterval script.

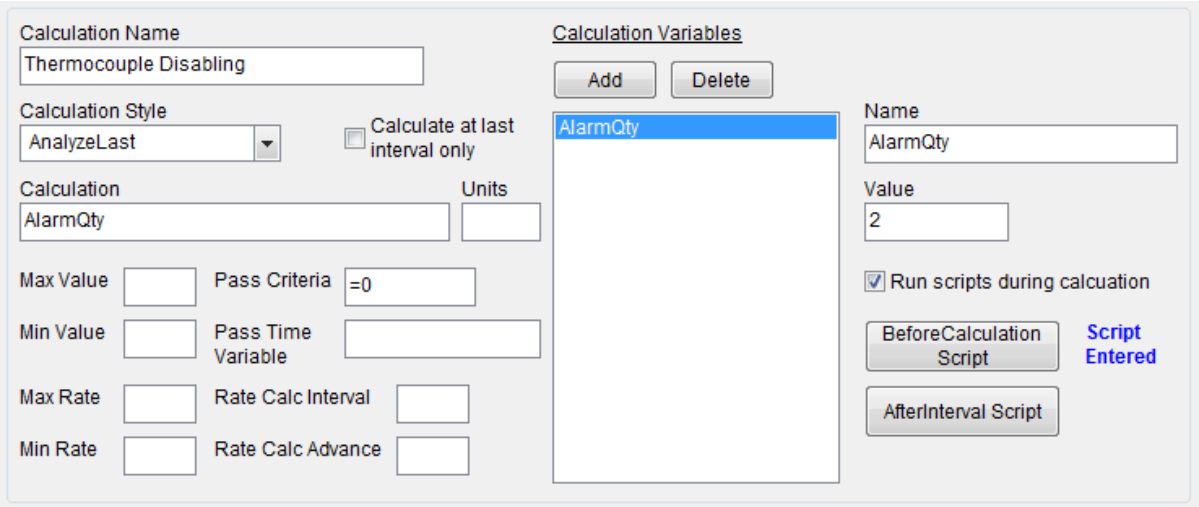
```
Sub AirTemp crosses 200F_AfterInterval()

  ' ** determine when AIRTC is greater than 200
  If Me.AIRTC\Value > 200 And Me.Result\Value = Off Then
    Me.Result\Value = On
    Me\ResultDisplay = "PASS: Air Temperature crossed 200F at " & Format(Me\RunTime, "0.0") & " mins."
  EndIf

EndSub
```

And here's the alternate output using the ResultDisplay.

```
AirTemp crosses 200F
PASS: Air Temperature crossed 200F at 84.0 mins.
```

Evaluate whether there were thermocouples disabled during the run

This example checks whether there were any thermocouple failures during the run. It will do this buy parsing and scanning through the run messages to identify any message that has “Sensor disabled” in the text. Because this analysis does not scan the Input Values records, we will set it up for AnalyzeLast so that it only scans one data point.



AlarmQty is the variable used to indicate the number of thermocouple failures. We will consider a value of zero (0) to be a Pass condition.

Because we are not scanning input data, we only have to use the BeforeCalculation script to setup our AlarmQty and ResultDisplay. Note that we use Chr(13) Carriage Return, Chr(10) Line-feed, and Chr(9) Tab to provide som multi-line formating for the result display.

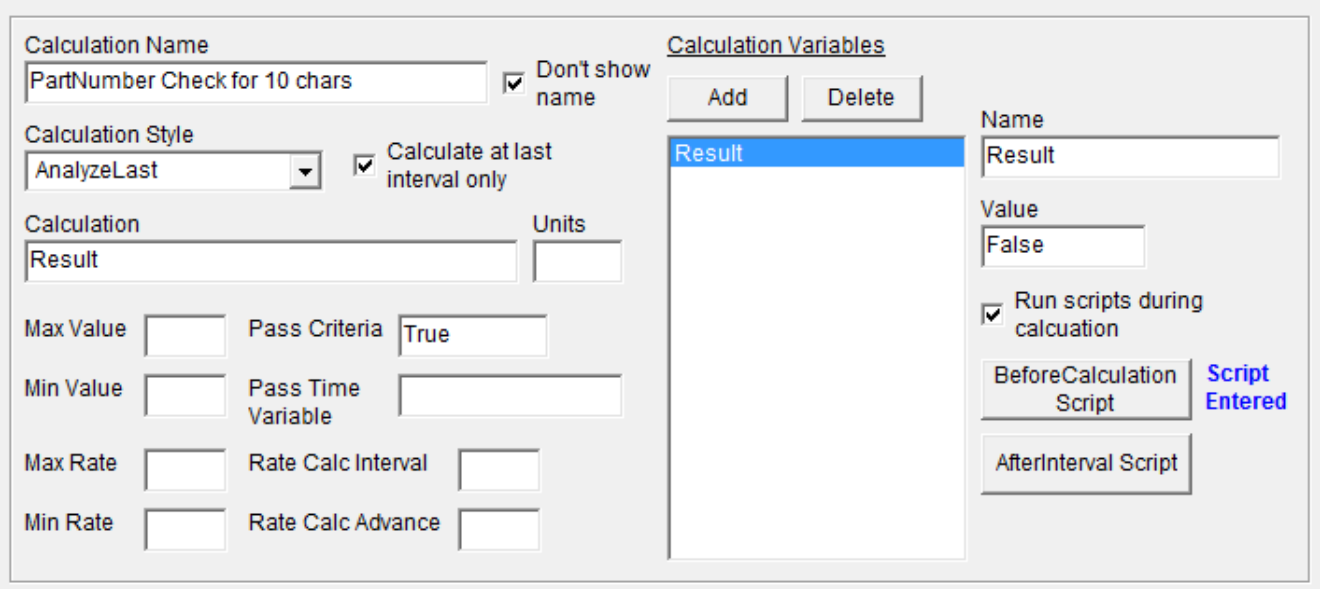
```
Sub Thermocouple Disabling_BeforeCalculation()

  ' ** Count the number of thermocouple disable alarm messages in the datafile

  Alias Parser = .Autoclave.DataBuyoff.Parsers.Message
  Dim i
  Dim Junk

  Me.AlarmQty\Value = 0
  Me\ResultDisplay = ""

  ' ** parse 1st index
  Parser\IndexToParse = 0
  Parser\Parse

  For i = 1 To Parser\RecordsCount
     Parser\IndexToParse = i
     Parser\Parse
     If Instr(1,Parser.Message\Text, "Sensor disable") > 0 Then
        Me.AlarmQty\Value = Me.AlarmQty\Value + 1
        If Me\ResultDisplay = "" Then
           Me\ResultDisplay = "FAIL:" & Chr(9) & "There were disabled thermocouples:" & Chr(13) & Chr(10) & Chr(9) & Parser.Message\Tagname
        Else
           Me\ResultDisplay = Me\ResultDisplay & "," & Parser.Message\Tagname
        EndIf
     EndIf
  Next i

  If Me.AlarmQty\Value = 0 Then
     Me\ResultDisplay = "PASS: There were no disabled thermocouples in this run."
  EndIf


EndSub
```

Here’s the report output:

```
   Thermocouple Disabling
***  FAIL:  There were disabled thermocouples:
            PTC5,PTC7
```

Evaluate whether part numbers entered have the correct number of characters

This example shows you how you can analyze specific part information. This analysis scans each part and determines whether the entered part number has 10 characters. If the part number fails this check, it will be identified.



Here are some things to consider:

- Because we will be analyzing part information, we really don't need to scan through the data intervals. For this reason, we're defaulting the calculation style to AnalyzeLast. In this case, the system will only scan the last data point.
- Calculate at last interval only – this is checked so that the Pass Criteria is only analyzed at the end. This has little affect because we have already told the system to scan the only the last interval.
- The "Don't Show Name" is checked. This will instruct the system to not show the Calculation Name in the report. This is selected so that the name can be part of the ResultDisplay variable, and in this way the *** exception display will be positioned next to the name. If the calculation name were printed, the *** would show on the second line.
- "Result" variable – this is created so that the BeforeCalculaton script can set it to True or False.
- Calculation – this is set to look at the Result variable.
- Pass Criteria – when Result = True, this will indicate a pass condition.
- BeforeCalculation script – because we won't be scanning through intervals, we only need to use the BeforeCalculation script to perform the parsing and analysis of the parts.

Here is the BeforeCalculation script.

```
Sub PartNumber Check For 10 chars_BeforeCalculation()


  ' ** Count the number of alarms messages in the datafile
  Alias Parser = .Autoclave.DataBuyoff.Parsers.Batch

  Dim i
  Dim PartNum
  Dim Chars
  Dim Fail


  Me.Result\Value = On
  Me\ResultDisplay = "Part Number check for 10 characters"


  Parser\IndexToParse = 0
  Parser\Parse
  Parser\IndexToParse = 0

  ' ** check if no parts
  If Parser\RecordsCount = 0 Then
    Me.Result\Value = On
    Me\ResultDisplay = "Fail.  No parts in cure."
    ExitSub
  EndIf

  Fail = False

  ' ** check if each partnumber has correct character count
  For i = 1 To Parser\RecordsCount
    Parser\Next
    PartNum= GetChildProp(Parser,"PartNumber","Value")
    Chars = Len(PartNum)
    If Chars <> 10 Then
      Fail = True
      Me.Result\Value = Off
      Me\ResultDisplay = Me\ResultDisplay & Chr(13) & Chr(10) & "Fail. " & PartNum & " has " & Chars & " characters."
    EndIf
  Next i

  If Fail = False Then
    Me\ResultDisplay = "Pass. All parts have 10 characters"
  EndIf


EndSub
```

Identifies the parser that will be used to scan the part information

Creates the title of the analysis

Performs a single parse to update RecordsCount

Exits with a Fail if there are no parts.

Parse through part records

Append messages if there is a Fail indication.

Here's what the script does:

1.) Sets an alias for the existing Batch parser.

2.) Presets the ResultsDisplay property and sets a default True for the Result variable.

3.) Peforms an initial Parse of the first part. This updates the RecordsCount property.

4.) If there are no parts, then the script will set Result to False, indicating a failure.

5.) Script runs through each part, checks the part number character count, and then issues a Fail result if it doesn't meet the 10-character requirement.

6.) If there is no failure, a message is added indicating a Pass.

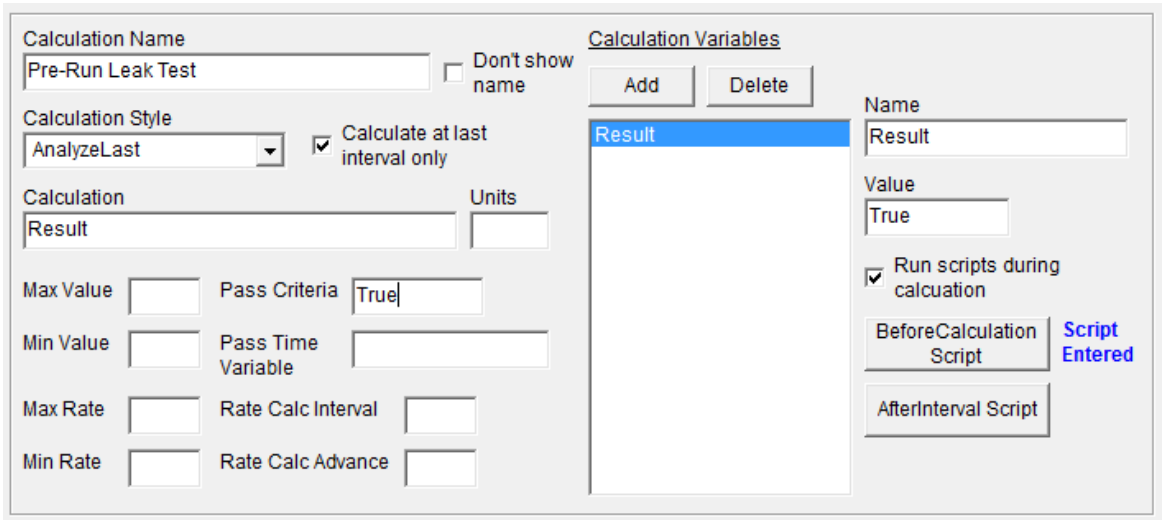
Here's the report output for parts that have failed:

```
*** Part Number check for 10 characters
    Fail. 5HF13832113 has 11 characters.
    Fail. 5HF13832114 has 11 characters.
```

Check that the pre-run leak test passed

This example shows how you can check the pre-run leak test results and issue a pass/fail based on those results. This information is stored to the Batch record of the datafile.

Here's the setup:



Here's the script.

```
Sub Pre-Run Leak Test_BeforeCalculation()

  Alias Parser = .Autoclave.DataBuyoff.Parsers.Batch

  Dim i
  Dim Junk
  Dim LeakValue
  Dim LeakRequirement
  Dim PartNumber

  Parser\Parse
  Parser\IndexToParse = 0

  Me.Result\Value = On

  For i = 1 To Parser\RecordsCount

     Parser\Next

     PartNumber = GetChildProp(Parser, "PartNumber","Value")
     LeakValue = GetChildProp(Parser, "LeakValue","Value")
     LeakValue = Format(LeakValue,"0.00 inchHg")
     LeakRequirement = GetChildProp(Parser, "LeakRequirement","Value")

     If Val(LeakValue) > Val(LeakRequirement) Then

        Me.Result\Value = Off

        If Me\ResultDisplay = "" Then
           Me\ResultDisplay = "Fail - " & PartNumber & " leaked " & LeakValue & " (Req: " & LeakRequirement & ")"
        Else
           Me\ResultDisplay = Me\ResultDisplay & Chr(13) & Chr(10) & "Fail - " & PartNumber & " Leaked " & LeakValue & " (Req: " & LeakRequirement & ")"
        EndIf
     Else
        If Me\ResultDisplay = "" Then
           Me\ResultDisplay = "Pass - " & PartNumber & " leaked " & LeakValue & " (Req: " & LeakRequirement & ")"
        Else
           Me\ResultDisplay = Me\ResultDisplay & Chr(13) & Chr(10) & "Pass - " & PartNumber & " leaked " & LeakValue & " (Req: " & LeakRequirement & ")"
        EndIf
     EndIf

  Next i

EndSub
```

Identifies the parser that will be used to scan the part information

Performs a single parse to update RecordsCount

Parse through part records

Gets values and formats them.

Checks for a failure

Append messages if there is a Fail indication.

Append messages if there is a Pass indication.

And here's the report output:

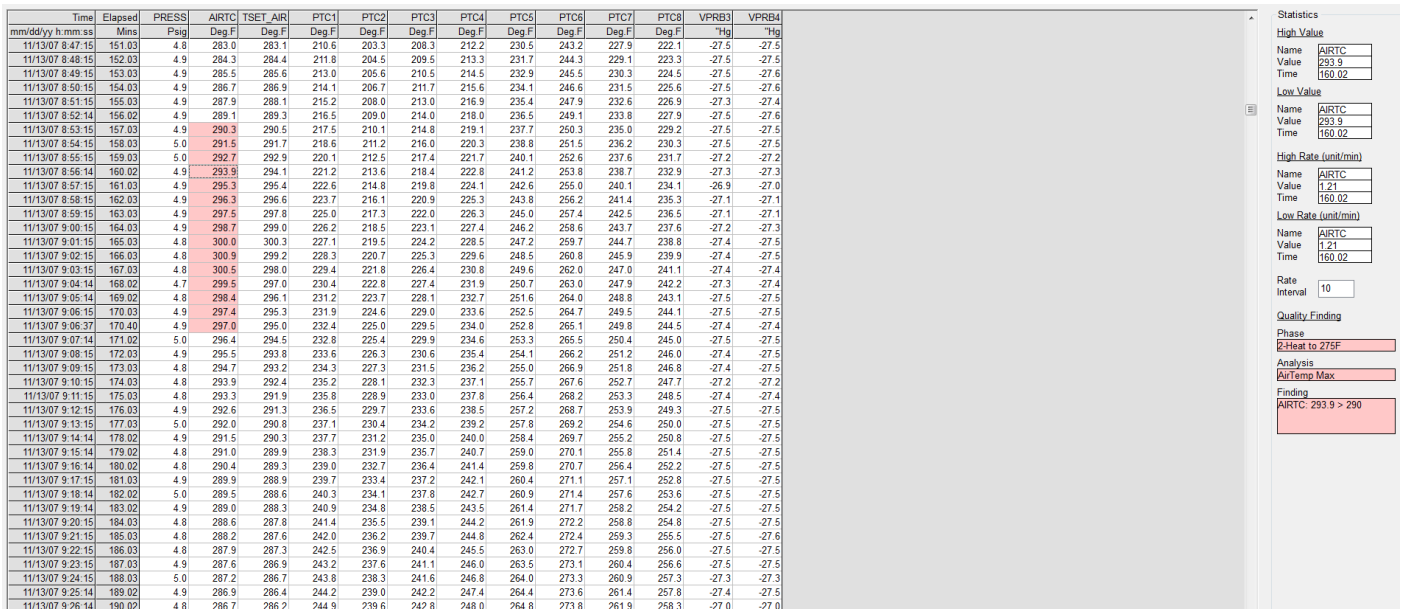
```
Pre-Run Leak Test
Pass - 5HF13832113 leaked 2.77 inchHg (Req: 3)
Pass - 5HF13832114 leaked 2.72 inchHg (Req: 3)
```

Numeric screen features

When selecting a specific quality report, the system will make changes to the reporting system's numeric display and highlight cells of data elements that resulted in a finding. From this screen, you can click on a cell to show the exact finding and limit that was exceeded.

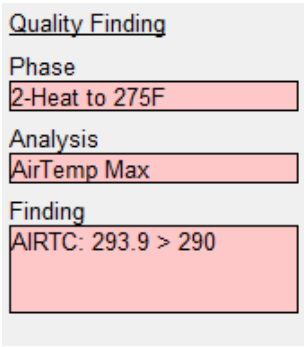
Value findings

For analysis and findings that involved values, the cell will be highlighted in red. When you click on the cell, the Quality Finding will be displayed to the right of the screen.



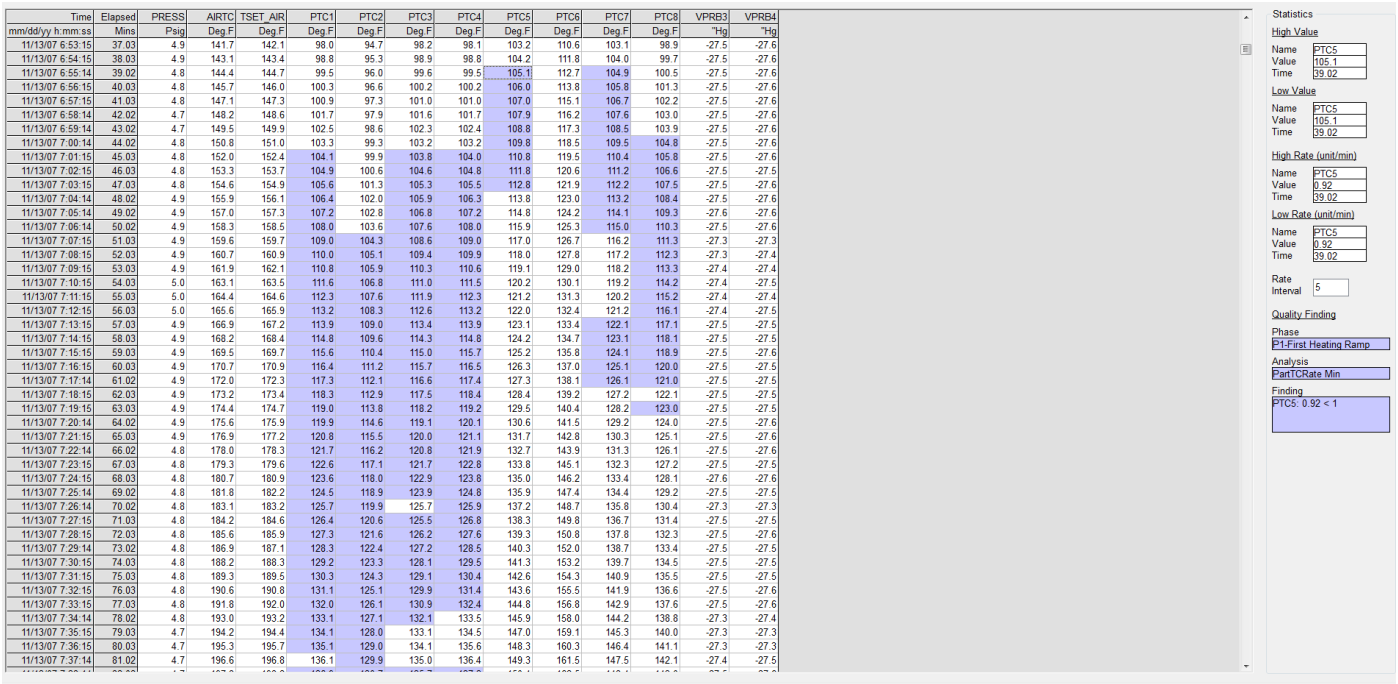
Time	Elapsed	PRESS	AIRTC	TSET_AIR	PTC1	PTC2	PTC3	PTC4	PTC5	PTC6	PTC7	PTC8	VPRB3	VPRB4
mm/dd/yy h:mm:ss	Mins	Psig	Deg.F	Deg.F	Deg.F	Deg.F	Deg.F	Deg.F	Deg.F	Deg.F	Deg.F	Deg.F	"Hg	"Hg
11/13/07 8:47:15	151.03	4.8	283.0	283.1	210.6	203.3	208.3	212.2	230.5	243.2	227.9	222.1	-27.5	-27.5
11/13/07 8:48:15	152.03	4.9	284.3	284.4	211.8	204.5	209.5	213.3	231.7	244.3	229.1	223.3	-27.5	-27.5
11/13/07 8:49:15	153.03	4.9	285.5	285.6	213.0	205.6	210.5	214.5	232.9	245.5	230.3	224.5	-27.5	-27.6
11/13/07 8:50:15	154.03	4.9	286.7	286.9	214.1	206.7	211.7	215.6	234.1	246.6	231.5	225.6	-27.5	-27.6
11/13/07 8:51:15	155.03	4.9	287.9	288.1	215.2	208.0	213.0	216.9	235.4	247.9	232.6	226.9	-27.3	-27.4
11/13/07 8:52:14	156.02	4.9	289.1	289.3	216.5	209.0	214.0	218.0	236.5	249.1	233.8	227.9	-27.5	-27.6
11/13/07 8:53:15	157.03	4.9	290.3	290.5	217.5	210.1	214.8	219.1	237.7	250.3	235.0	229.2	-27.5	-27.5
11/13/07 8:54:15	158.03	5.0	291.5	291.7	218.6	211.2	216.0	220.3	238.8	251.5	236.2	230.3	-27.5	-27.5
11/13/07 8:55:15	159.03	5.0	292.7	292.9	220.1	212.5	217.4	221.7	240.1	252.6	237.6	231.7	-27.2	-27.2
11/13/07 8:56:14	160.02	4.9	293.9	294.1	221.2	213.6	218.4	222.8	241.2	253.8	238.7	232.9	-27.3	-27.3
11/13/07 8:57:15	161.03	4.9	295.3	295.4	222.6	214.8	219.8	224.1	242.6	255.0	240.1	234.1	-26.9	-27.0
11/13/07 8:58:15	162.03	4.9	296.3	296.6	223.7	216.1	220.9	225.3	243.8	256.2	241.4	235.3	-27.1	-27.1
11/13/07 8:59:15	163.03	4.9	297.5	297.8	225.0	217.3	222.0	226.3	245.0	257.4	242.5	236.5	-27.1	-27.1
11/13/07 9:00:15	164.03	4.9	298.7	299.0	226.2	218.5	223.1	227.4	246.2	258.6	243.7	237.6	-27.2	-27.3
11/13/07 9:01:15	165.03	4.8	300.0	300.3	227.1	219.5	224.2	228.5	247.2	259.7	244.7	238.8	-27.4	-27.5
11/13/07 9:02:15	166.03	4.8	300.9	299.2	228.3	220.7	225.3	229.6	248.5	260.8	245.9	239.9	-27.4	-27.5
11/13/07 9:03:15	167.03	4.8	300.5	298.0	229.4	221.8	226.4	230.8	249.6	262.0	247.0	241.1	-27.4	-27.4
11/13/07 9:04:14	168.02	4.7	299.5	297.0	230.4	222.8	227.4	231.9	250.7	263.0	247.9	242.2	-27.3	-27.4
11/13/07 9:05:14	169.02	4.8	298.4	296.1	231.2	223.7	228.1	232.7	251.6	264.0	248.8	243.1	-27.5	-27.5
11/13/07 9:06:15	170.03	4.9	297.4	295.3	231.9	224.6	229.0	233.6	252.5	264.7	249.5	244.1	-27.5	-27.5
11/13/07 9:06:37	170.40	4.9	297.0	295.0	232.4	225.0	229.5	234.0	252.8	265.1	249.8	244.5	-27.4	-27.4
11/13/07 9:07:14	171.02	5.0	296.4	294.5	232.8	225.4	229.9	234.6	253.3	265.5	250.4	245.0	-27.5	-27.5
11/13/07 9:08:15	172.03	4.9	295.5	293.8	233.6	226.3	230.6	235.4	254.1	266.2	251.2	246.0	-27.4	-27.5
11/13/07 9:09:15	173.03	4.8	294.7	293.2	234.3	227.3	231.5	236.2	255.0	266.9	251.8	246.8	-27.4	-27.5
11/13/07 9:10:15	174.03	4.8	293.9	292.4	235.2	228.1	232.3	237.1	255.7	267.6	252.7	247.7	-27.2	-27.2
11/13/07 9:11:15	175.03	4.8	293.3	291.9	235.8	228.9	233.0	237.8	256.4	268.2	253.3	248.5	-27.4	-27.4
11/13/07 9:12:15	176.03	4.9	292.6	291.3	236.5	229.7	233.6	238.5	257.2	268.7	253.9	249.3	-27.5	-27.5
11/13/07 9:13:15	177.03	5.0	292.0	290.8	237.1	230.4	234.2	239.2	257.8	269.2	254.6	250.0	-27.5	-27.5
11/13/07 9:14:14	178.02	4.9	291.5	290.3	237.7	231.2	235.0	240.0	258.4	269.7	255.2	250.8	-27.5	-27.5
11/13/07 9:15:14	179.02	4.8	291.0	289.9	238.3	231.9	235.7	240.7	259.0	270.1	255.8	251.4	-27.5	-27.5
11/13/07 9:16:14	180.02	4.8	290.4	289.3	239.0	232.7	236.4	241.4	259.8	270.7	256.4	252.2	-27.5	-27.5
11/13/07 9:17:15	181.03	4.9	289.9	288.9	239.7	233.4	237.2	242.1	260.4	271.1	257.1	252.8	-27.5	-27.5
11/13/07 9:18:14	182.02	5.0	289.5	288.6	240.3	234.1	237.8	242.7	260.9	271.4	257.6	253.6	-27.5	-27.5
11/13/07 9:19:14	183.02	4.9	289.0	288.3	240.9	234.8	238.5	243.5	261.4	271.7	258.2	254.2	-27.5	-27.5
11/13/07 9:20:15	184.03	4.8	288.6	287.8	241.4	235.5	239.1	244.2	261.9	272.2	258.8	254.8	-27.5	-27.5
11/13/07 9:21:15	185.03	4.8	288.2	287.6	242.0	236.2	239.7	244.8	262.4	272.4	259.3	255.5	-27.5	-27.6
11/13/07 9:22:15	186.03	4.8	287.9	287.3	242.5	236.9	240.4	245.5	263.0	272.7	259.8	256.0	-27.5	-27.5
11/13/07 9:23:15	187.03	4.9	287.6	286.9	243.2	237.6	241.1	246.0	263.5	273.1	260.4	256.6	-27.5	-27.5
11/13/07 9:24:15	188.03	5.0	287.2	286.7	243.8	238.3	241.6	246.8	264.0	273.3	260.9	257.3	-27.3	-27.3
11/13/07 9:25:14	189.02	4.9	286.9	286.4	244.2	239.0	242.2	247.4	264.4	273.6	261.4	257.8	-27.4	-27.5
11/13/07 9:26:14	190.02	4.8	286.7	286.2	244.9	239.6	242.8	248.0	264.8	273.8	261.9	258.3	-27.0	-27.0

When you click on the cell, the Quality Finding will be displayed to the right of the screen. This will show the phase name, the analysis name, and the sensor, value, and limit that was exceeded.



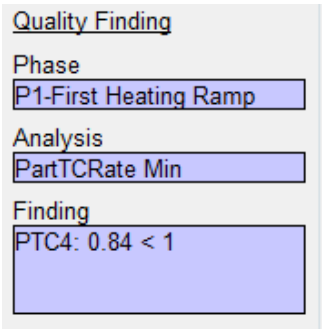
Rate findings

For analysis and findings that involved rates, the cell will be highlighted in blue.



Time	Elapsed	PRESS	AIRTC	TSET_AIR	PTC1	PTC2	PTC3	PTC4	PTC5	PTC6	PTC7	PTC8	VPRB3	VPRB4
mm/dd/yy h:mm:ss	Mins	Psig	Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	"Hg	"Hg
11/13/07 6:53:15	37.03	4.9	141.7	142.1	98.0	94.7	98.2	98.1	103.2	110.6	103.1	98.9	-27.5	-27.6
11/13/07 6:54:15	38.03	4.9	143.1	143.4	98.8	95.3	98.9	98.8	104.2	111.8	104.0	99.7	-27.5	-27.6
11/13/07 6:55:14	39.02	4.8	144.4	144.7	99.5	96.0	99.6	99.5	105.1	112.7	104.9	100.5	-27.5	-27.6
11/13/07 6:56:15	40.03	4.8	145.7	146.0	100.3	96.6	100.2	100.2	106.0	113.8	105.8	101.3	-27.5	-27.6
11/13/07 6:57:15	41.03	4.8	147.1	147.3	100.9	97.3	101.0	101.0	107.0	115.1	106.7	102.2	-27.5	-27.6
11/13/07 6:58:14	42.02	4.7	148.2	148.6	101.7	97.9	101.6	101.7	107.9	116.2	107.6	103.0	-27.5	-27.6
11/13/07 6:59:14	43.02	4.7	149.5	149.9	102.5	98.6	102.3	102.4	108.8	117.3	108.5	103.9	-27.5	-27.6
11/13/07 7:00:14	44.02	4.8	150.8	151.0	103.3	99.3	103.2	103.2	109.8	118.5	109.5	104.8	-27.5	-27.6
11/13/07 7:01:15	45.03	4.8	152.0	152.4	104.1	99.9	103.8	104.0	110.8	119.5	110.4	105.8	-27.5	-27.6
11/13/07 7:02:15	46.03	4.8	153.3	153.7	104.9	100.6	104.6	104.8	111.8	120.6	111.2	106.6	-27.5	-27.5
11/13/07 7:03:15	47.03	4.8	154.6	154.9	105.6	101.3	105.3	105.5	112.8	121.9	112.2	107.5	-27.5	-27.6
11/13/07 7:04:14	48.02	4.9	155.9	156.1	106.4	102.0	105.9	106.3	113.8	123.0	113.2	108.4	-27.5	-27.6
11/13/07 7:05:14	49.02	4.9	157.0	157.3	107.2	102.8	106.8	107.2	114.8	124.2	114.1	109.3	-27.6	-27.6
11/13/07 7:06:14	50.02	4.9	158.3	158.5	108.0	103.6	107.6	108.0	115.9	125.3	115.0	110.3	-27.5	-27.6
11/13/07 7:07:15	51.03	4.9	159.6	159.7	109.0	104.3	108.6	109.0	117.0	126.7	116.2	111.3	-27.3	-27.3
11/13/07 7:08:15	52.03	4.9	160.7	160.9	110.0	105.1	109.4	109.9	118.0	127.8	117.2	112.3	-27.3	-27.4
11/13/07 7:09:15	53.03	4.9	161.9	162.1	110.8	105.9	110.3	110.6	119.1	129.0	118.2	113.3	-27.4	-27.4
11/13/07 7:10:15	54.03	5.0	163.1	163.5	111.6	106.8	111.0	111.5	120.2	130.1	119.2	114.2	-27.4	-27.5
11/13/07 7:11:15	55.03	5.0	164.4	164.6	112.3	107.6	111.9	112.3	121.2	131.3	120.2	115.2	-27.4	-27.4
11/13/07 7:12:15	56.03	5.0	165.6	165.9	113.2	108.3	112.6	113.2	122.0	132.4	121.2	116.1	-27.4	-27.5
11/13/07 7:13:15	57.03	4.9	166.9	167.2	113.9	109.0	113.4	113.9	123.1	133.4	122.1	117.1	-27.5	-27.5
11/13/07 7:14:15	58.03	4.9	168.2	168.4	114.8	109.6	114.3	114.8	124.2	134.7	123.1	118.1	-27.5	-27.5
11/13/07 7:15:15	59.03	4.9	169.5	169.7	115.6	110.4	115.0	115.7	125.2	135.8	124.1	118.9	-27.5	-27.6
11/13/07 7:16:15	60.03	4.9	170.7	170.9	116.4	111.2	115.7	116.5	126.3	137.0	125.1	120.0	-27.5	-27.5
11/13/07 7:17:14	61.02	4.9	172.0	172.3	117.3	112.1	116.6	117.4	127.3	138.1	126.1	121.0	-27.5	-27.5
11/13/07 7:18:15	62.03	4.9	173.2	173.4	118.3	112.9	117.5	118.4	128.4	139.2	127.2	122.1	-27.5	-27.5
11/13/07 7:19:15	63.03	4.9	174.4	174.7	119.0	113.8	118.2	119.2	129.5	140.4	128.2	123.0	-27.5	-27.5
11/13/07 7:20:14	64.02	4.9	175.6	175.9	119.9	114.6	119.1	120.1	130.6	141.5	129.2	124.0	-27.5	-27.6
11/13/07 7:21:15	65.03	4.9	176.9	177.2	120.8	115.5	120.0	121.1	131.7	142.8	130.3	125.1	-27.5	-27.6
11/13/07 7:22:14	66.02	4.8	178.0	178.3	121.7	116.2	120.8	121.9	132.7	143.9	131.3	126.1	-27.5	-27.6
11/13/07 7:23:15	67.03	4.8	179.3	179.6	122.6	117.1	121.7	122.8	133.8	145.1	132.3	127.2	-27.5	-27.5
11/13/07 7:24:15	68.03	4.8	180.7	180.9	123.6	118.0	122.9	123.8	135.0	146.2	133.4	128.1	-27.6	-27.6
11/13/07 7:25:14	69.02	4.8	181.8	182.2	124.5	118.9	123.9	124.8	135.9	147.4	134.4	129.2	-27.5	-27.5
11/13/07 7:26:14	70.02	4.8	183.1	183.2	125.7	119.9	125.7	125.9	137.2	148.7	135.8	130.4	-27.3	-27.3
11/13/07 7:27:15	71.03	4.8	184.2	184.6	126.4	120.6	125.5	126.8	138.3	149.8	136.7	131.4	-27.5	-27.5
11/13/07 7:28:15	72.03	4.8	185.6	185.9	127.3	121.6	126.2	127.6	139.3	150.8	137.8	132.3	-27.5	-27.6
11/13/07 7:29:14	73.02	4.8	186.9	187.1	128.3	122.4	127.2	128.5	140.3	152.0	138.7	133.4	-27.5	-27.5
11/13/07 7:30:15	74.03	4.8	188.2	188.3	129.2	123.3	128.1	129.5	141.3	153.2	139.7	134.5	-27.5	-27.5
11/13/07 7:31:15	75.03	4.8	189.3	189.5	130.3	124.3	129.1	130.4	142.6	154.3	140.9	135.5	-27.5	-27.5
11/13/07 7:32:15	76.03	4.8	190.6	190.8	131.1	125.1	129.9	131.4	143.6	155.5	141.9	136.6	-27.5	-27.6
11/13/07 7:33:15	77.03	4.8	191.8	192.0	132.0	126.1	130.9	132.4	144.8	156.8	142.9	137.6	-27.5	-27.6
11/13/07 7:34:14	78.02	4.8	193.0	193.2	133.1	127.1	132.1	133.5	145.9	158.0	144.2	138.8	-27.3	-27.4
11/13/07 7:35:15	79.03	4.7	194.2	194.4	134.1	128.0	133.1	134.5	147.0	159.1	145.3	140.0	-27.3	-27.3
11/13/07 7:36:15	80.03	4.7	195.3	195.7	135.1	129.0	134.1	135.6	148.3	160.3	146.4	141.1	-27.3	-27.3
11/13/07 7:37:14	81.02	4.7	196.6	196.8	136.1	129.9	135.0	136.4	149.3	161.5	147.5	142.1	-27.4	-27.5

When you click on the cell, the Quality Finding will be displayed to the right of the screen.This will show the phase name, the analysis name, and the sensor, value, and limit that was exceeded.

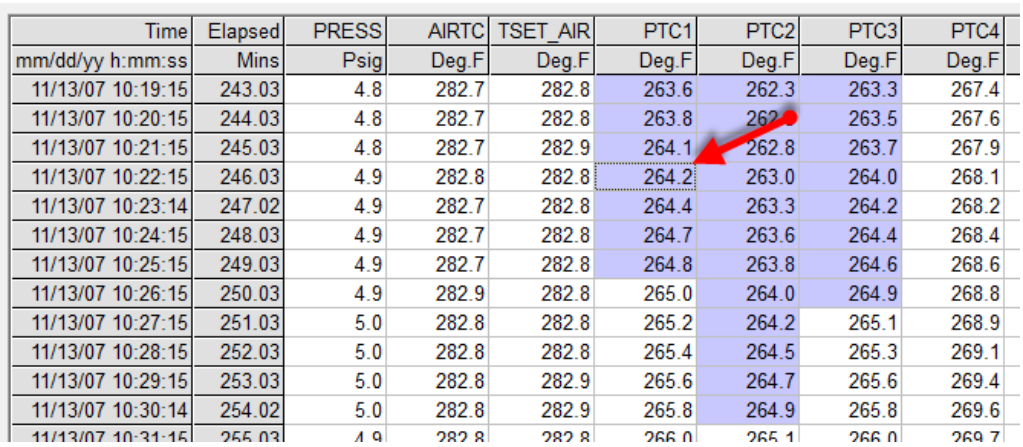


Checking a specific finding

You can select a given cell and the numeric screen will show you the rate and value at that cell. This can be used to verify the rate calculatons. For example, for this finding:

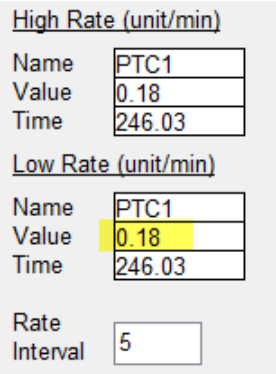
*** Min Temp Rate from 100 to 265 Degs = 0.18 Deg/Min From PTC1 at 246.03 mins. (Req: 1.00 Deg/Min)

You can click on the PTC1 cell at 246.03 and see the rate.



Time	Elapsed	PRESS	AIRTC	TSET_AIR	PTC1	PTC2	PTC3	PTC4
mm/dd/yy h:mm:ss	Mins	Psig	Deg.F	Deg.F	Deg.F	Deg.F	Deg.F	Deg.F
11/13/07 10:19:15	243.03	4.8	282.7	282.8	263.6	262.3	263.3	267.4
11/13/07 10:20:15	244.03	4.8	282.7	282.8	263.8	262.5	263.5	267.6
11/13/07 10:21:15	245.03	4.8	282.7	282.9	264.1	262.8	263.7	267.9
11/13/07 10:22:15	246.03	4.9	282.8	282.8	264.2	263.0	264.0	268.1
11/13/07 10:23:14	247.02	4.9	282.7	282.8	264.4	263.3	264.2	268.2
11/13/07 10:24:15	248.03	4.9	282.7	282.8	264.7	263.6	264.4	268.4
11/13/07 10:25:15	249.03	4.9	282.7	282.8	264.8	263.8	264.6	268.6
11/13/07 10:26:15	250.03	4.9	282.9	282.8	265.0	264.0	264.9	268.8
11/13/07 10:27:15	251.03	5.0	282.8	282.8	265.2	264.2	265.1	268.9
11/13/07 10:28:15	252.03	5.0	282.8	282.8	265.4	264.5	265.3	269.1
11/13/07 10:29:15	253.03	5.0	282.8	282.9	265.6	264.7	265.6	269.4
11/13/07 10:30:14	254.02	5.0	282.8	282.9	265.8	264.9	265.8	269.6
11/13/07 10:31:15	255.03	4.9	282.8	282.8	266.0	265.1	266.0	269.7

The information to the side of the screen will show you the exact calculations used by the card:



High Rate (unit/min)

Name	PTC1
Value	0.18
Time	246.03

Low Rate (unit/min)

Name	PTC1
Value	0.18
Time	246.03

Rate Interval: 5

Note that the Rate Interval will match the specific card's rate calc interval too.

Card validation and testing

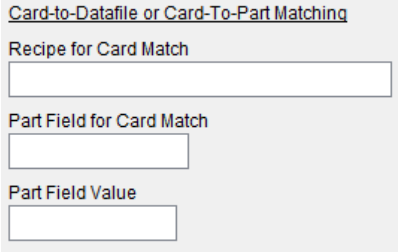
During card creation, you will want to validate certain sections. CPC's reporting system provides useful information to validate the performance of quality cards.

Test with datafiles

It is always easiest to test quality cards on actual run data. This data can be used to show analysis, phase transitions, and other information.

Make sure your card is not matched

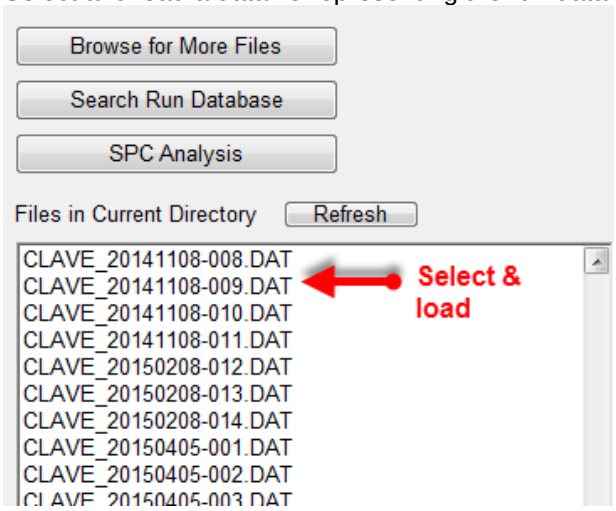
Although in production use your card will likely be associated with a specific Recipe or part field, when in validation/testing mode make sure you remove those two features. This will allow the card to be selected and not change during testing.



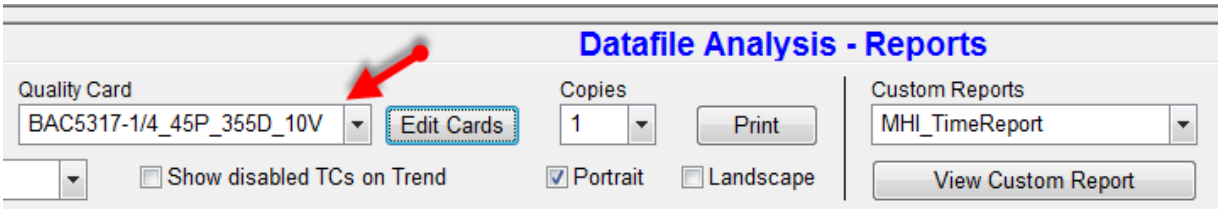
Testing and validation process

Here is the testing process.

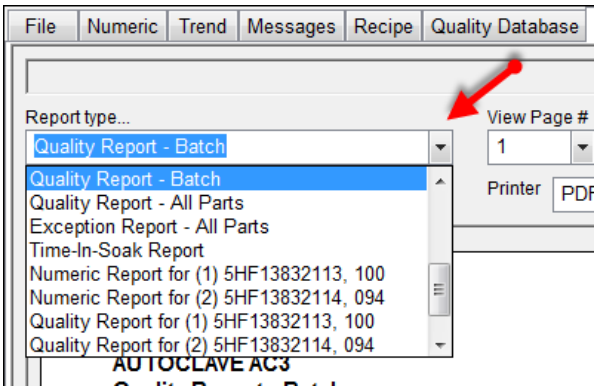
1. Select and load a datafile representing the run data that matches the card requirements



2. Select the card you want to test or evaluate from the drop-down listing on the Reports tab. When the card is selected, it will default the current report to a Batch report.



3. Now, select the report type. If you want to have a report per part, then select the Quality - All Parts report. If you want a batch buyoff where all parts sensors are considered and analyzed together, then leave the Quality – Batch report.



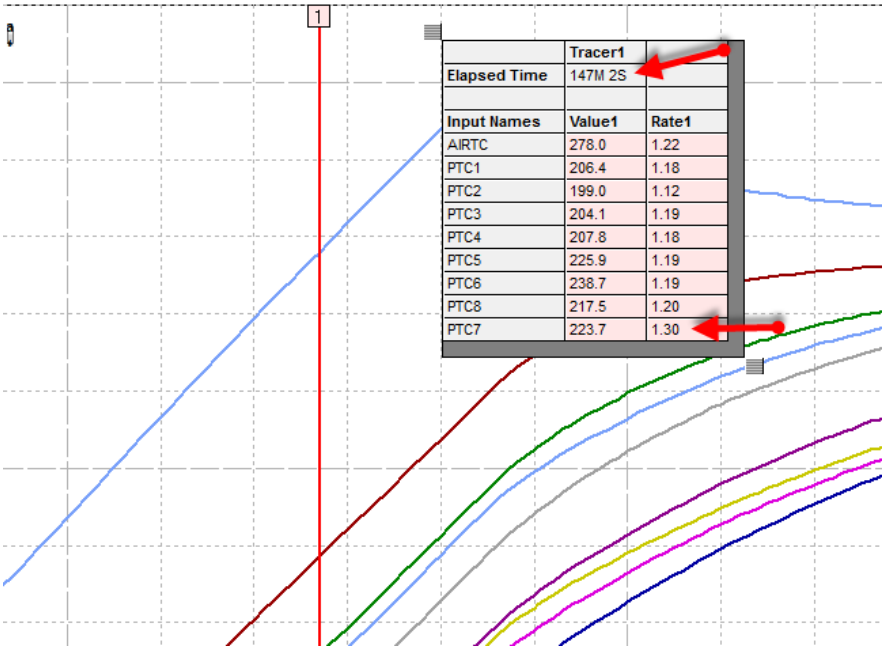
4. Now you will be able to see the output of the card. Check the output and validate the results based on the actual run data. It's best to go phase to phase and look at the output with each change.

CRITICAL BATCH SUMMARY

First Heating Ramp, Start: 0.00 Mins., End: 290.03 Mins., Duration: 290.03 Mins.

	Part Temperature Analysis	
	Max Temp Rate from 100 to 265 Degs = 1.30 Deg/Min From PTC7 at 147.03 mins.	(Req: 5.00 Deg/Min)
***	Min Temp Rate from 100 to 265 Degs = 0.18 Deg/Min From PTC1 at 246.03 mins.	(Req: 1.00 Deg/Min)
	Max Temp = 277.8 Deg. From PTC6 at 285.03 mins.	(Req: 285.0 Deg.)
	Min Temp = 265.1 Deg. From PTC2 at 255.03 mins.	(Req: 265.0 Deg.)
	Min Soak Time = 50.00 Mins From PTC2	(Req: 30.0 Mins)
***	Max Soak Time = 128.63 Mins From PTC6	(Req: 60.0 Mins)
	AirTemp crosses 200F	
	Pass. Result = True at 84.03 mins	(Req: True)

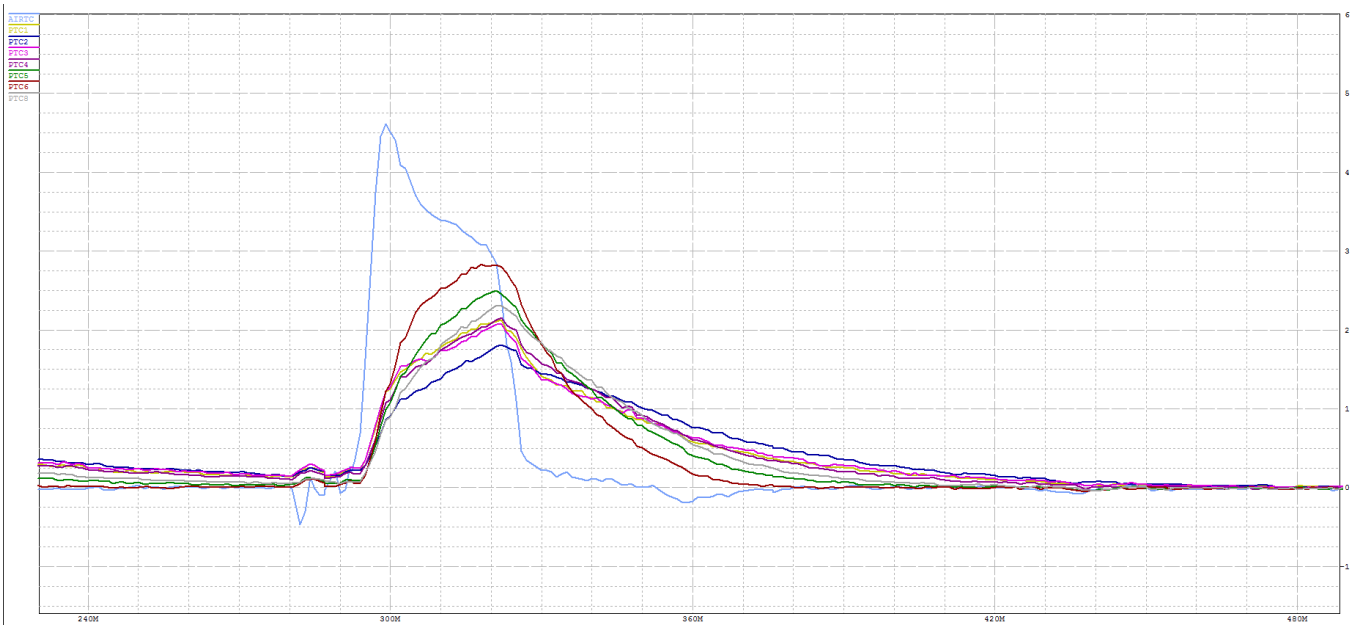
5. You can utilize the Trend display with a Traceline to show the values and rates at specific points. So, in the example above, if we want to verify the Max Temp Rate, we can setup a traceline at 147.03mins and then read the traceline rate value. *Note: This requires that the trend's RateCalcTime = the card's RateCalc.*



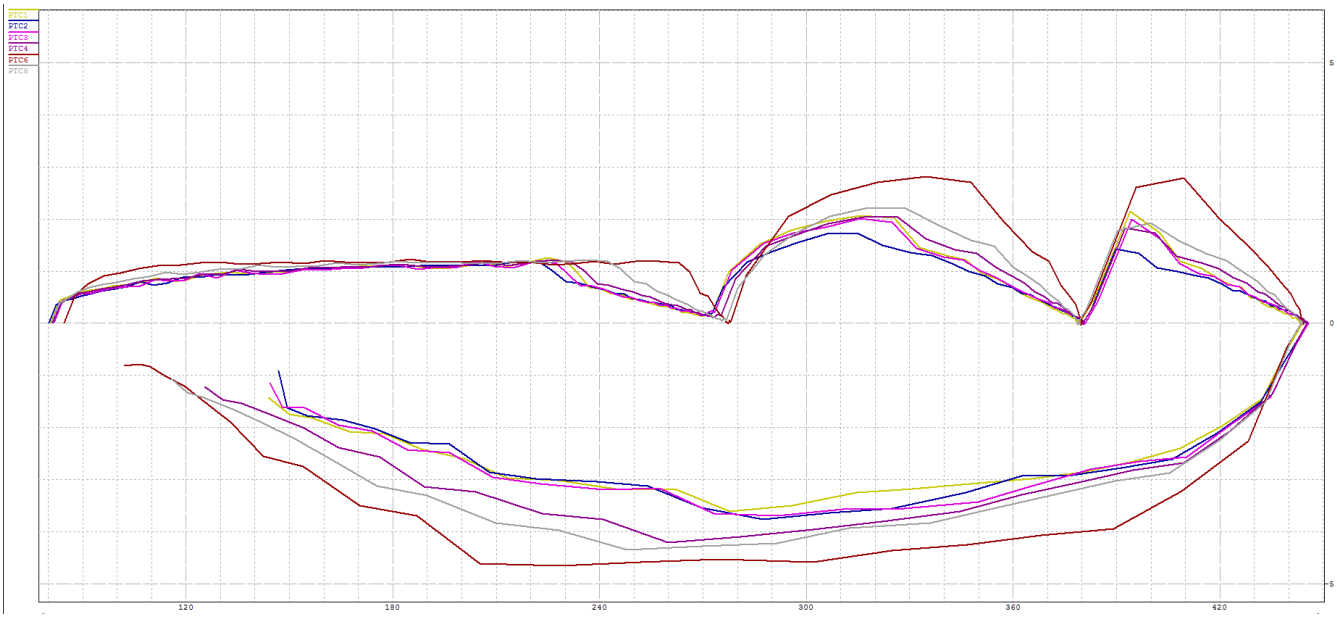
Note that the RateCalcInterval can be setup on the DataAnalyze object.

TrendViewRateInterval	5m

6. You can also switch the trend to a Time-vs-Rate trend to show trends by time. This lets you see maximum and minimum rates over a specific time.



7. Or you can trend Rate-vs-Temperature to visualize the rates by specific range.



8. You can also utilize the Numeric screen to show information about the data and findings. See next section for these capabilities.

Final card implementation

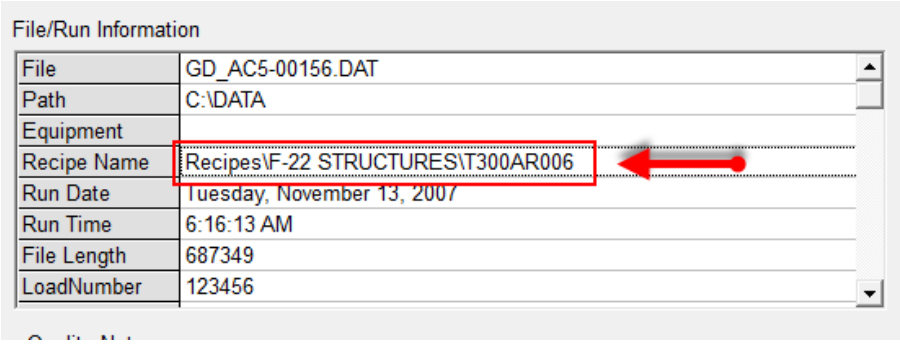
Once the card is completed and validated, you can mark it “Ready for Production” and then start using it.

Matching a card to a cure recipe

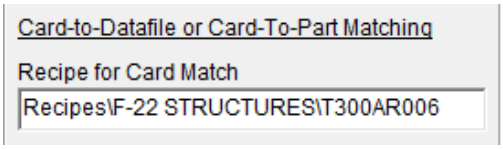
If you want the card to be automatically selected and a quality report to be generated after a run, then you will want to match the card with a recipe or a part.

To match to a recipe, the card’s Recipe Match field should include the recipe name stored to the specific datafile.

First, get the exact name from the datafile selection tab on the reporting screen. If the name includes a path, then the path must be included verbatim in the match field.



Enter that recipe name in the card’s matching field.



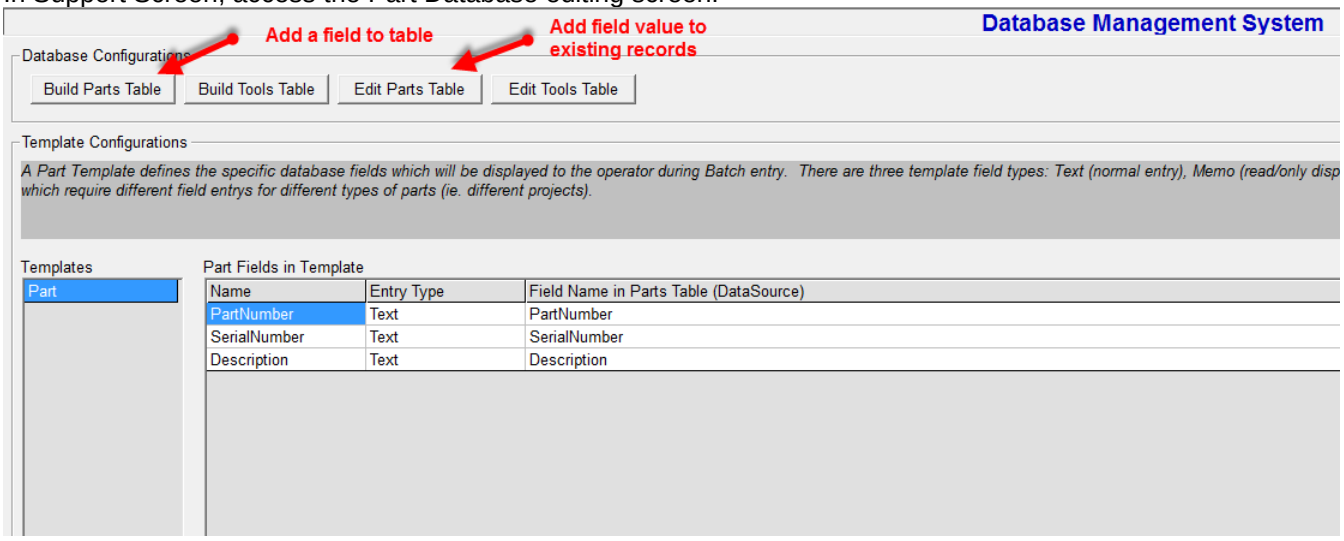
Once this is done, every future run will where a Quality Report is requested will be analyzed using this card.

Matching a card to a specific part

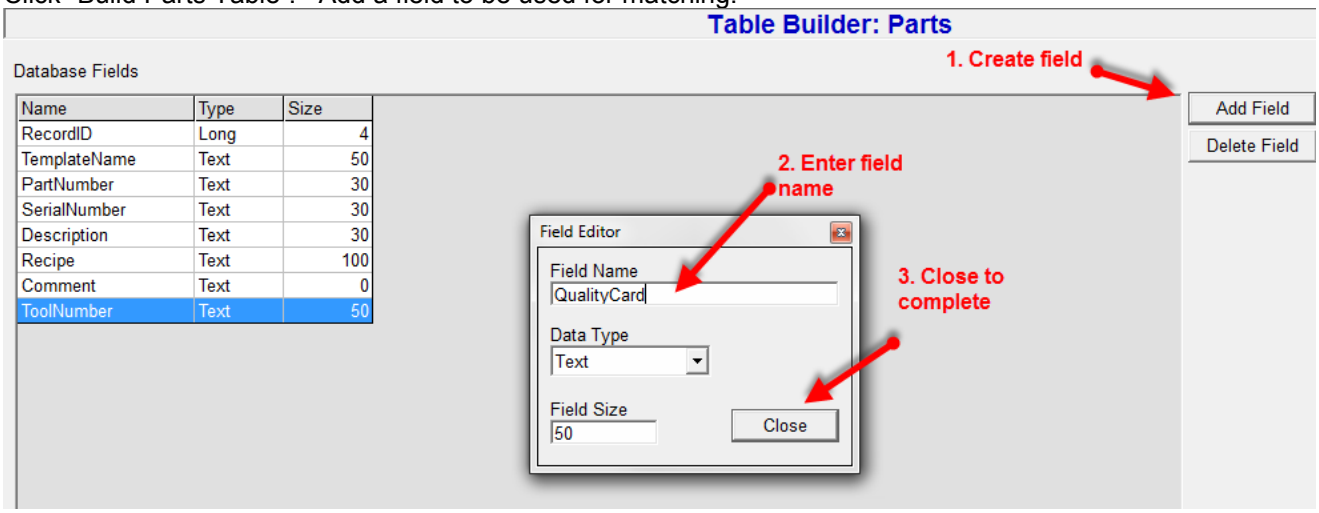
If you want the card to be automatically selected based on a specific part, then you’ll need to setup a field in the part database that will be the matching field for the card.

Here’s the step-by-step process for adding a field:

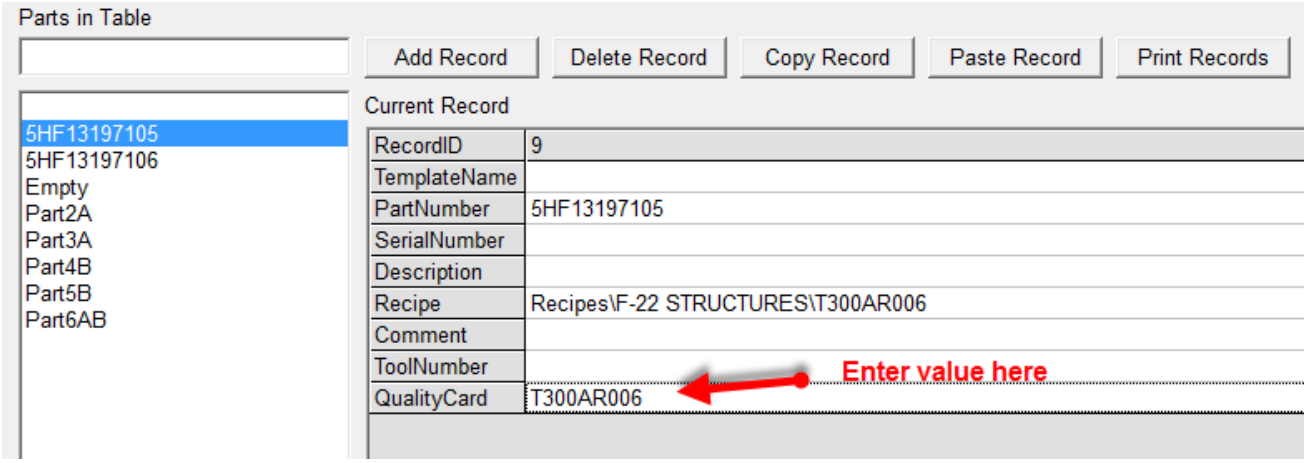
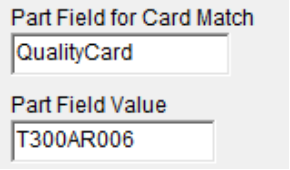
1.) In Support Screen, access the Part Database editing screen.



2.) Click “Build Parts Table”. Add a field to be used for matching.



3.) Once field is added, click the “Edit Part Table” and edit the part records to associate the part or parts to a specific card.



4.) Once parts are associated, set your card to look at the correct field and value.