



The 10,000-foot view
has never looked better.



THE HUB®

SOFTWARE USER GUIDE

**Process Monitoring, Process Development,
Mold Transfer, and Simulation Support**



RJG
MOLD SMART

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The Hub for Process Monitoring

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Introduction

Read, understand, and comply with all following instructions.

Disclaimer


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Alerts

The following alert types are used as needed to further clarify or highlight information presented in this document:

 **DEFINITION** *A definition or clarification of a term or terms used in the text.*

 **NOTE** *A note provides additional information about a discussion topic.*

 **CAUTION** *A caution is used to make the operator aware of conditions that can cause damage to equipment and/or injury to personnel.*

Introduction (continued)

The Hub Licensed Software Applications

The Hub software is available in different software application packages: The Hub for Process Monitoring; The Hub for Process Development, The Hub for Mold Transfer; The Hub for Simulation Import; and The Hub OPC UA Server. The features described in this guide include all available software application package features; some features may not be available depending upon license purchased.

The Hub for Process Monitoring

The Hub for Process Monitoring provides the following:

- network-wide status overview
- job status overview
- quick-access graphs
- job reports

The Hub for Process Development

The Hub for Process Analytics provides the following:

- Summary and detail reports of networked machines/molds
- Overall machine performance and status
- Mold settings
- Alarms or issues
- Historical CoPilot data backup
- Individual machine processes and trends

The Hub for Mold Transfer

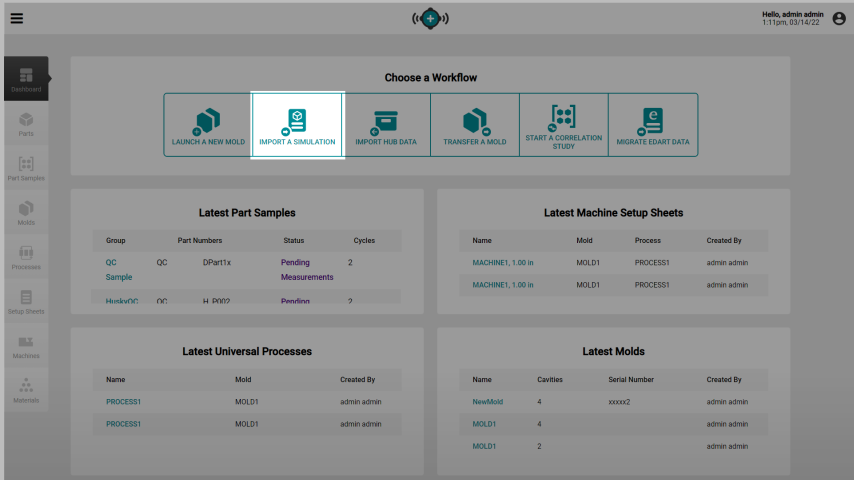
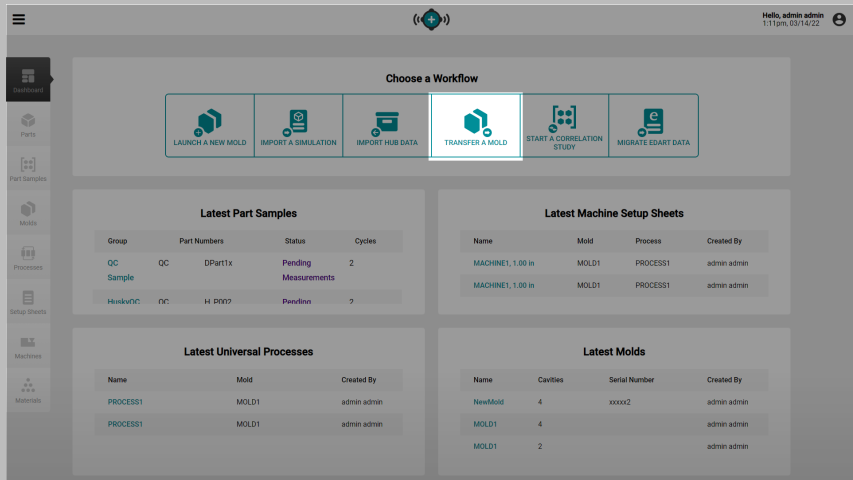
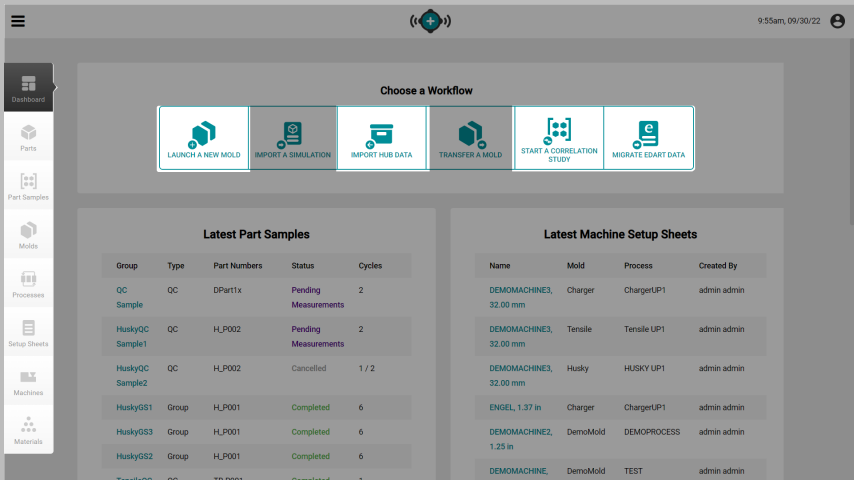
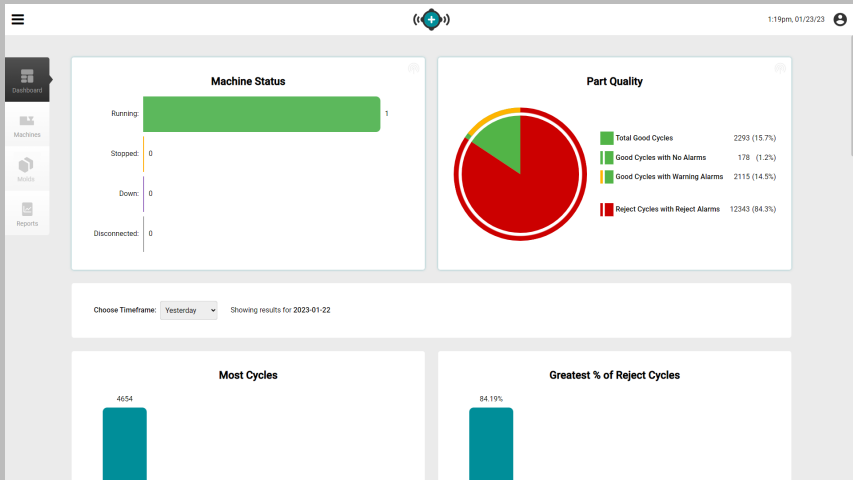
The Hub for Mold Transfer generates part processes with machine-independent values and setup sheets with machine-dependent values; launches new molds using specific mold/machine/process combinations, or transfers existing molds from a user-entered database of mold, machine, part, process, and material records.

The Hub for Simulation Support

The Hub for Simulation Support provides import of Moldex3D, Moldflow simulation files and a database.

The Hub OPC UA Server











The Hub® software Open Platform Communications Unified Architecture (OPC UA) server facilitates the transfer of RJG job information, summary variables, and alarm changes from The Hub software to a Manufacturing Execution System (MES) using Transmission Control Protocol (TCP) communication.
















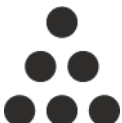

Introduction (continued)

Software Icons and Navigation

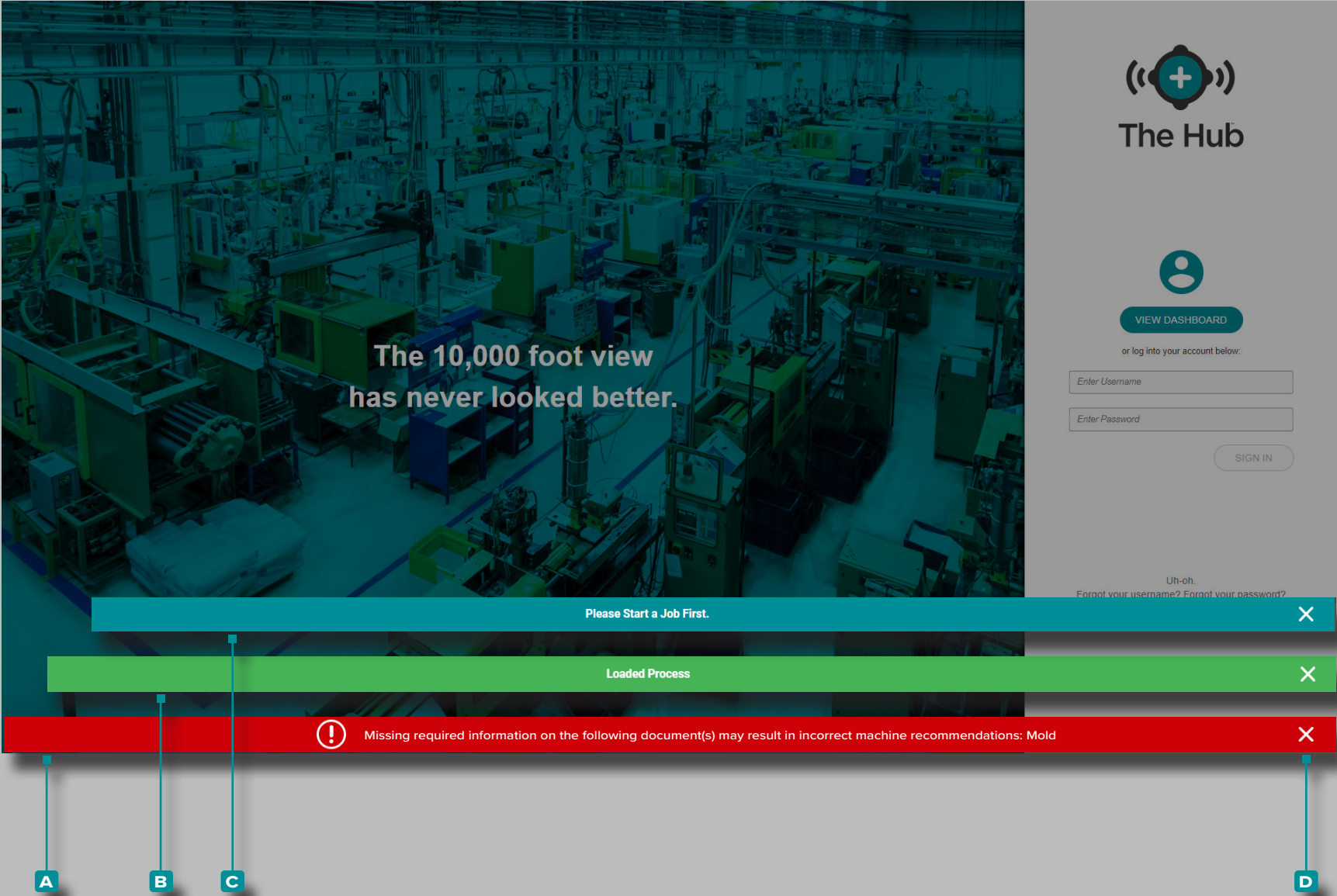
The following details commonly used icons and their functions in The Hub’s software.

 The Hub	Reload Page	Click the object to reload The Hub Dashboard view.	 Expand Information	Click the object to view full job information.	 Information	Click the object to view job reports.
 Select Columns	Click the object to view and select which column headings to display on the screen.	 Exit Window	Click the object to exit an open window.	 Updating Connection	Hover over the object to view the date/time of the latest connection update.	
 Sort Column	Click a table heading to sort the contents alphabetically or numerically, click again to change sorting by either ascending or descending order.	 Search	Click the object, then enter a term to search the list of molds, machines, materials, parts, processes, and setup sheets.	 Connected/ Activated	The object indicates a connection or activation status.	
 Check Box	Click the object to select or deselect.	 Filter by Keyword or Phrase	Click in the field next to the object and enter a keyword or phrase by which to filter the records.	 Show Disconnected Machines	Click the object to view disconnected machines and jobs.	
 Help	Click the object to view Diagnostics.					

Introduction *(continued)*

	Settings	Click the object to view available settings for the current item.		Machines	Click the object to view, create, or edit Machine records.		Setup Sheets	Click the object to view, create, or edit Setup Sheet records.
	User	Tap the object to view user information.		Molds	Click the object to view, create, or edit Parts records.		Compare Records	Enables the selection of two records for comparison; refer to "Comparing Records" on page 32.
	Roles	Tap the object to view role settings and permissions for users.		Processes	Click the object to view, create, or edit Process records.		Launch a New Mold	Click the object to Launch a New Mold.
	Devices	Tap the object to view device information.		Parts	Click the object to view, create, or edit Parts records.		Import a Simulation	Click the object to Import a Simulation.
	Dashboard	Click the object to view the Dashboard.		Materials	Click the object to view, create, or edit Material records.		Transfer a Mold	Click the object to Transfer a Mold.

Introduction (continued)




Software Notifications

Software notifications appear across the bottom of the screen.

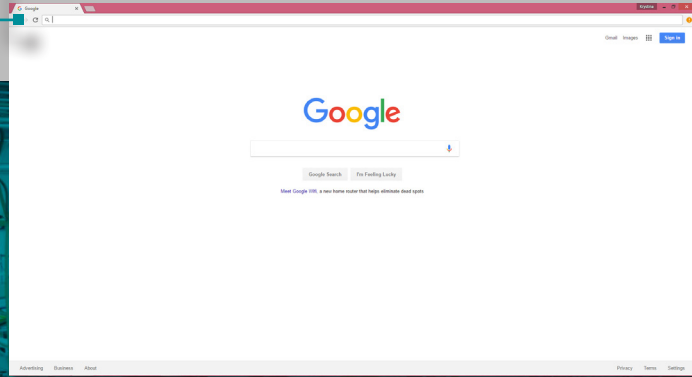
Error A notifications appear due to missing or incorrect information, or general software errors; *error notifications may be red or yellow, depending upon the required action's urgency.* Read the error to determine the error type and the corrective action required.

Success B notifications appear as a confirmation of any changes or commands that have been made in the software.

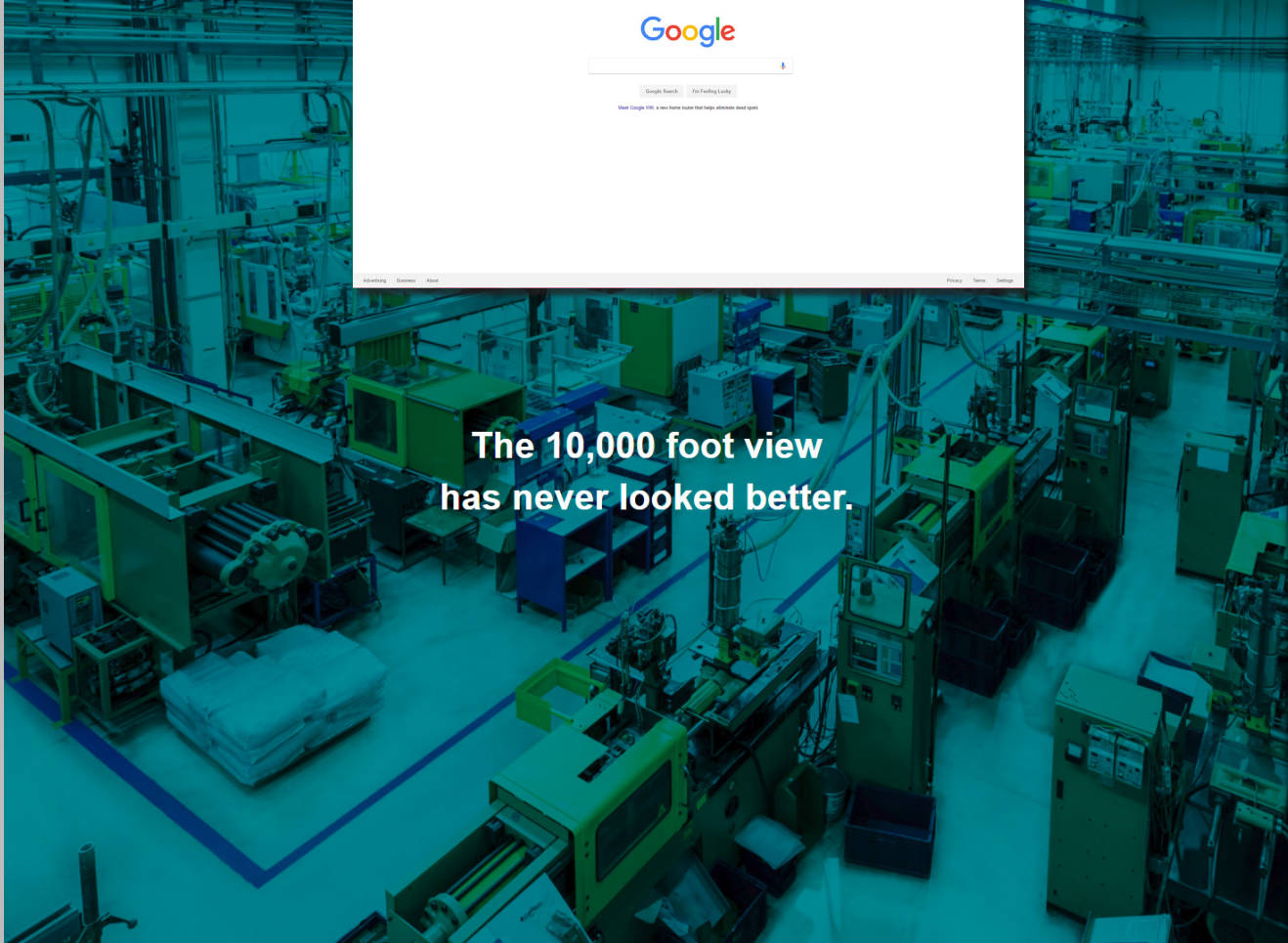
Information C notifications provide additional information for user assistance.

Tap  the **D exit** icon to dismiss the notification from the screen.

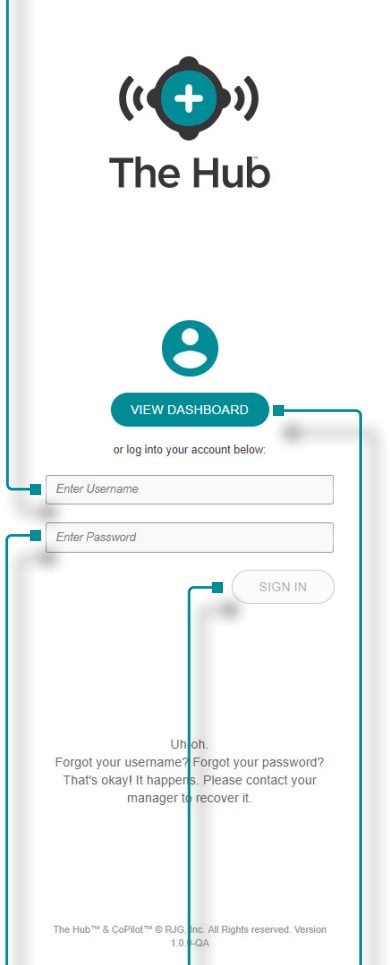
Introduction (continued)



A



**The 10,000 foot view
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B

C

D

E

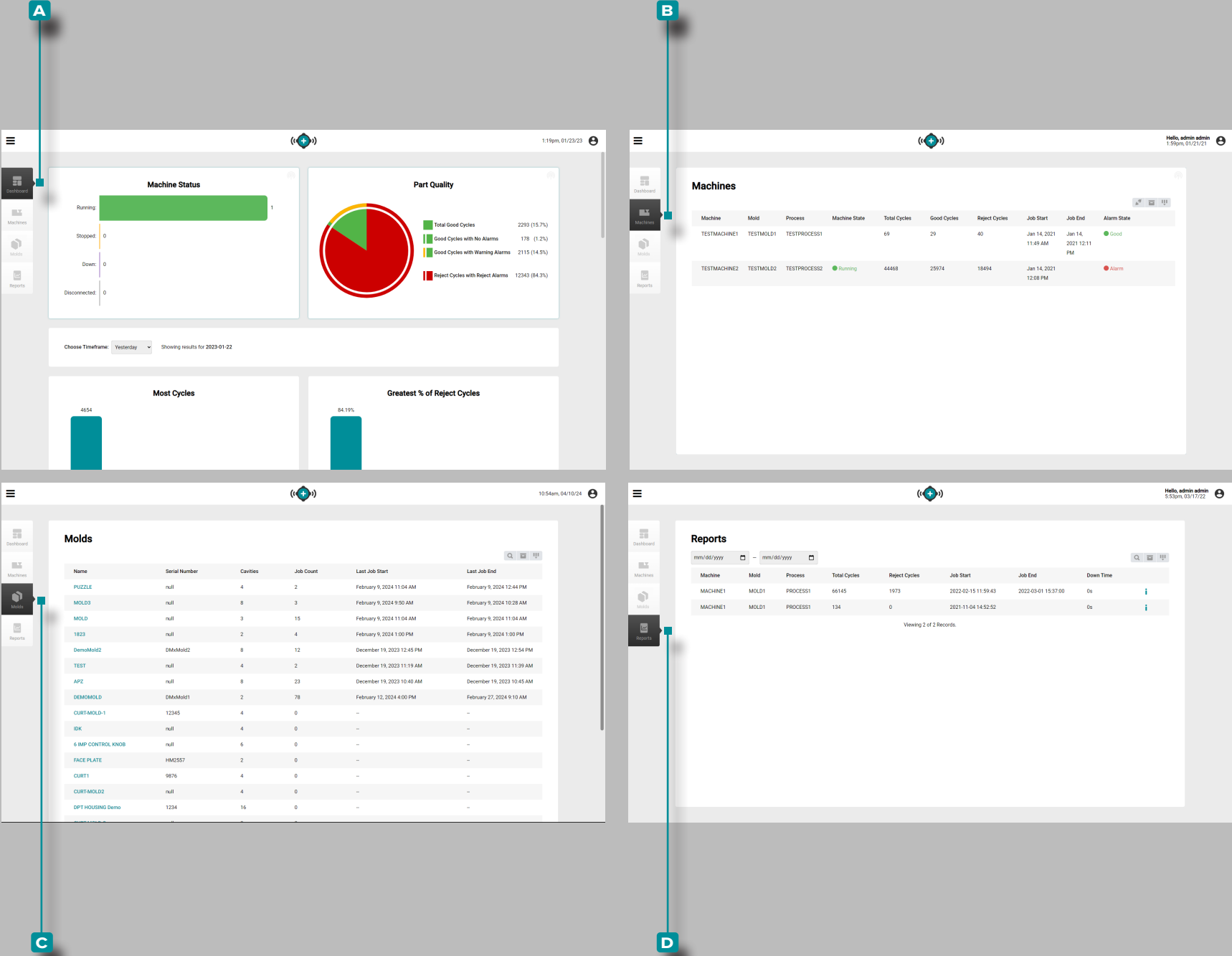
User Login

To view The Hub® software, open **A** Google Chrome and **enter** the assigned IP address or domain in the browser address bar.

The Hub software requires users to log in with a username and password before use. **Enter** the assigned **B** username and **C** password, then **click** the **D** Sign In button to log in to the Hub.

Users without usernames and passwords may view the dashboard only; **click** the **E** View Dashboard button to view the Dashboard.

The Hub for Process Monitoring



Application Overview

The Hub for Process Monitoring has three main pages, or views, where users can access data, view graphs and records, and generate reports.

The **A Dashboard** view provides an overall view of the machine status and part quality in the network, along with eight pre-populated, mini-reports, all displayed within a selectable time frame.

The **B Machines** view provides a detailed view of each machine and machine status in the network.

The **C Molds** view provides an overview of all jobs for each mold.

The **D Reports** view provides a record of jobs by machine.

The Hub for Process Monitoring

Dashboard

The Dashboard provides an overall view of machine status and part quality in the network in the **A Machine Status Graph**, **B Part Quality Graph**, and eight pre-populated tables that display the top five jobs within the selected time range in each category: Most Cycles, Greatest [Percent] % Reject Cycle, Most Alarms, Longest Down Time, Longest Run Time, Exceeded Cycle Time, Machine Out of Match, and Mold Out of Match.


The Dashboard **A Machine Status Graph** and **B Part Quality Graph** display job data from jobs that have been active within the past 24 hours.

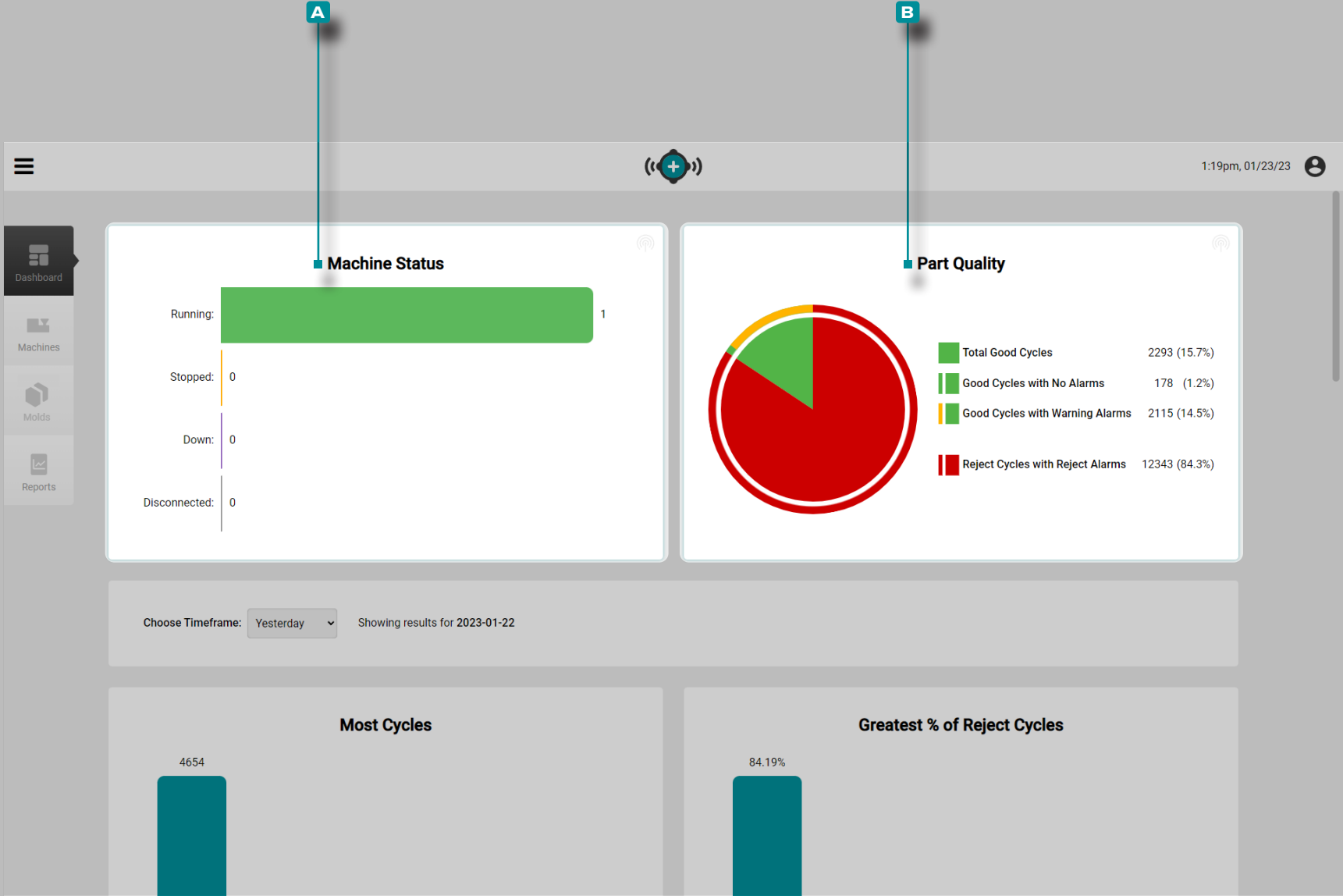
Machine Status Graph

The **A Machine Status Graph** displays—in real-time—the number of running, stopped, disconnected, and down machines in the facility.

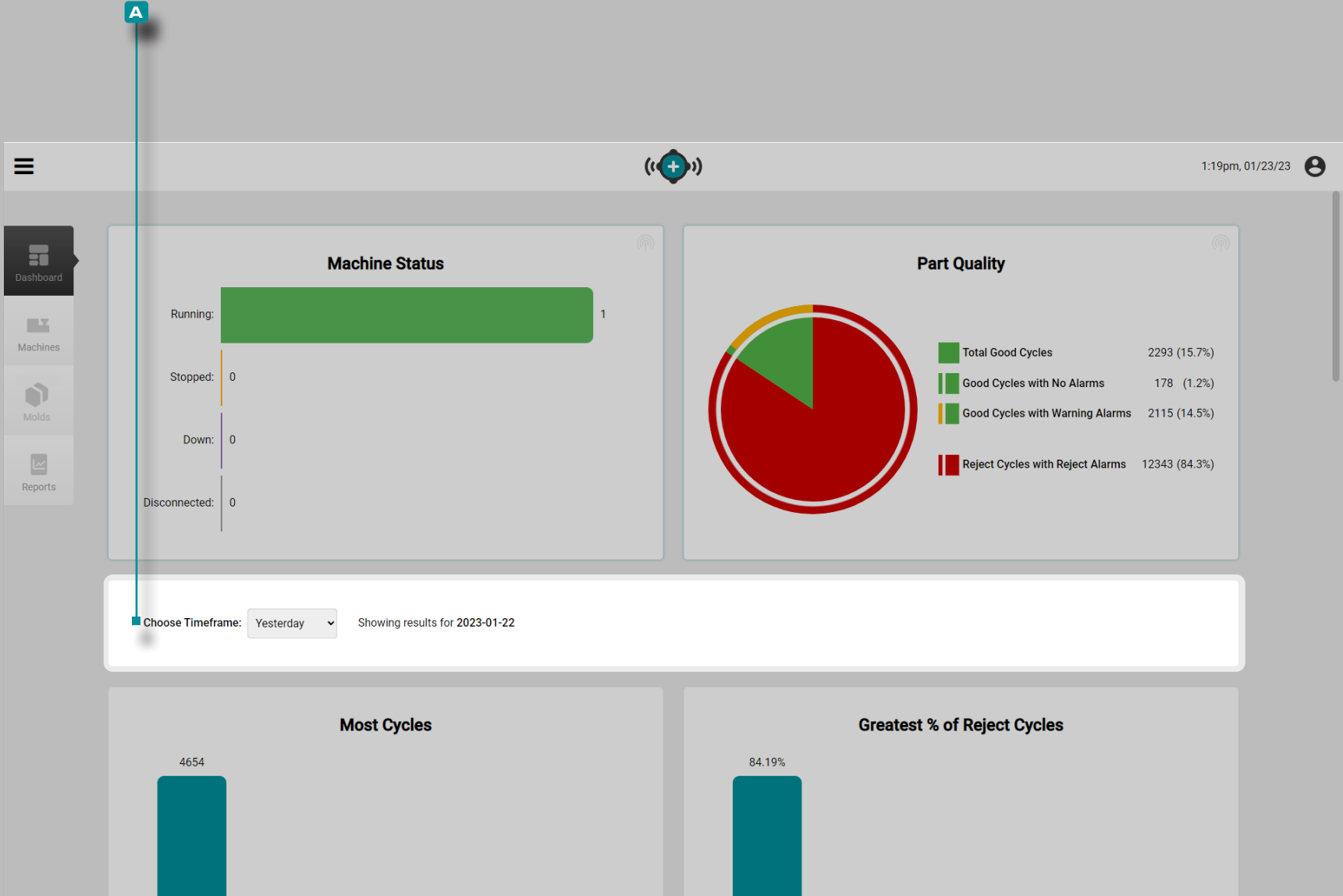
Part Quality Graph

The **B Part Quality Graph** displays the number of good cycles, good cycles with no alarms, good cycles with warning alarms, and reject cycles with reject alarms from jobs that have been active within the past 24 hours.

Hover  over the mouse pointer over the icon to view the Last Update date and time for either the Machine Status or Part Quality graph.



The Hub for Process Monitoring

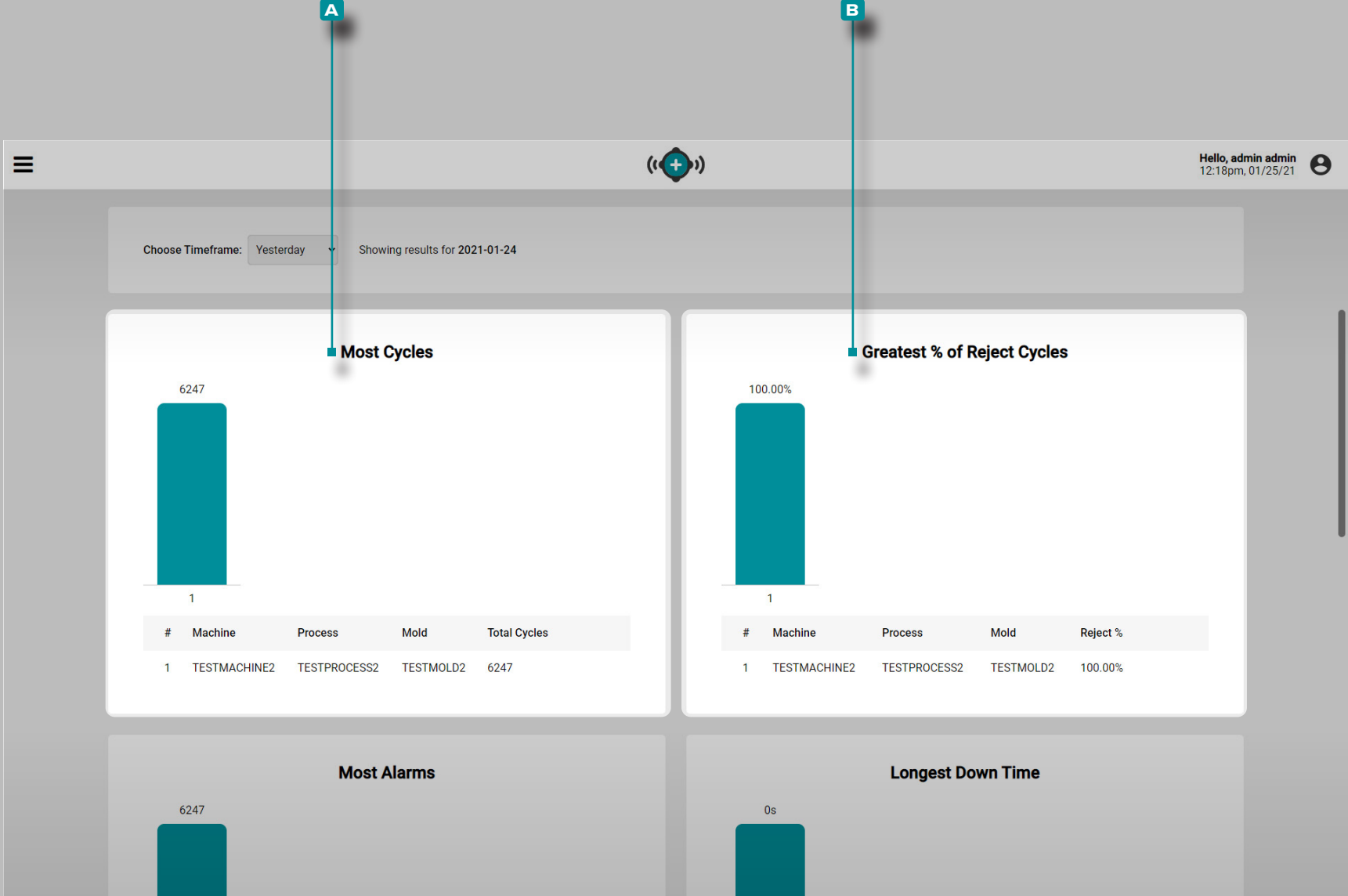


Dashboard Tables

The Dashboard summary report tables display job data from jobs that have been active within the selected time range on the **A Choose Timeframe: drop-down menu**.

Click the **A Choose Timeframe: drop-down menu** to select Yesterday, Last Hour, Last 8 Hours, Last Week, or Last Month to view the data displayed *in the tables* below the graphs in that time range.

The Hub for Process Monitoring



(Dashboard Tables, *continued*)

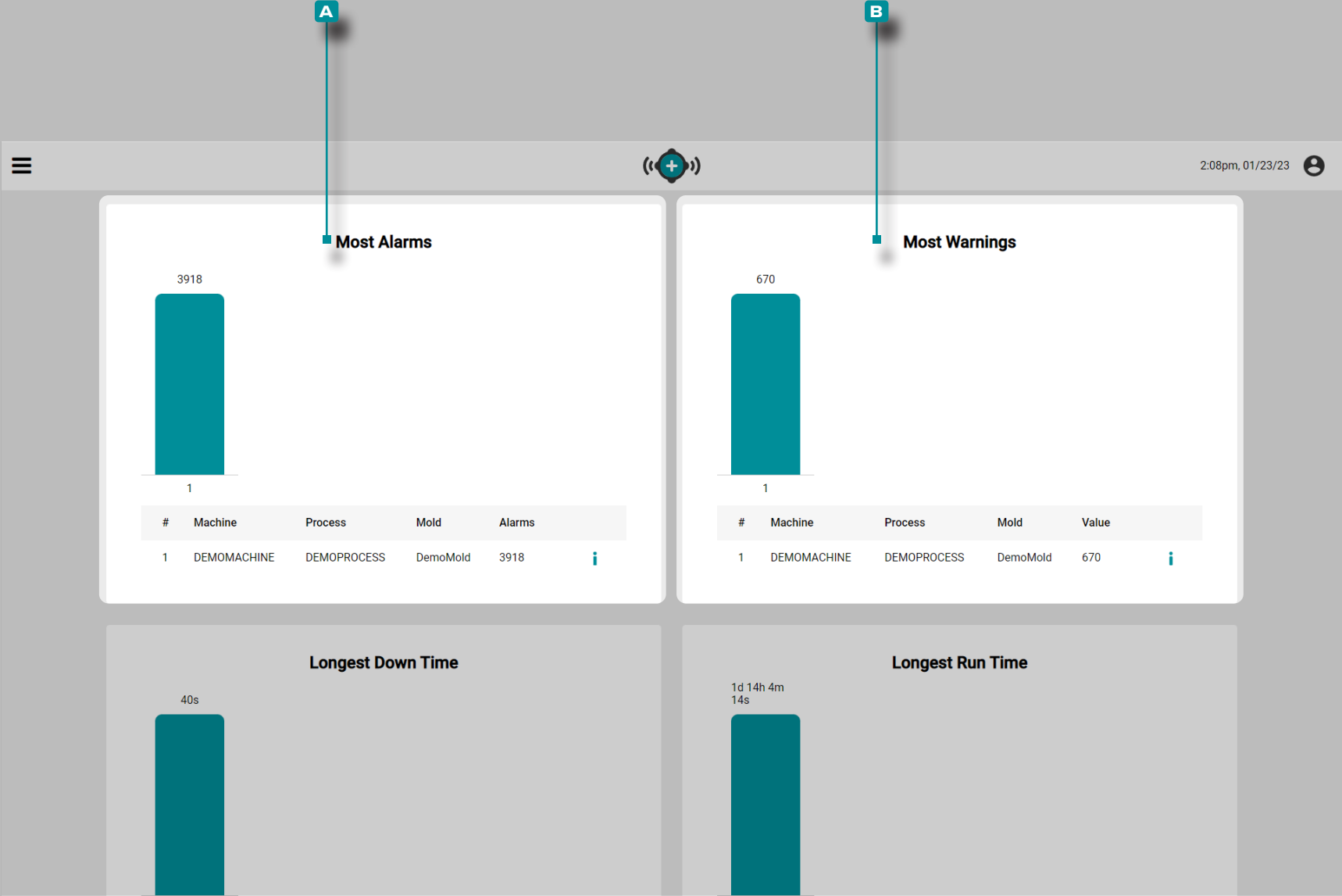
Most Cycles Table

The **A** **Most Cycles** table provides a table view of each job that has been active within the selected timeframe, and lists the machine name, process name, mold name, and total cycles.

Greatest [Percent] % Reject Cycle Table

The **B** **Greatest [Percent] % Reject Cycles** table provides a table view of each job that has been active within the selected timeframe, and lists the machine name, process name, mold name, and reject [percent] % of each job.

The Hub for Process Monitoring



(Dashboard Tables, *continued*)

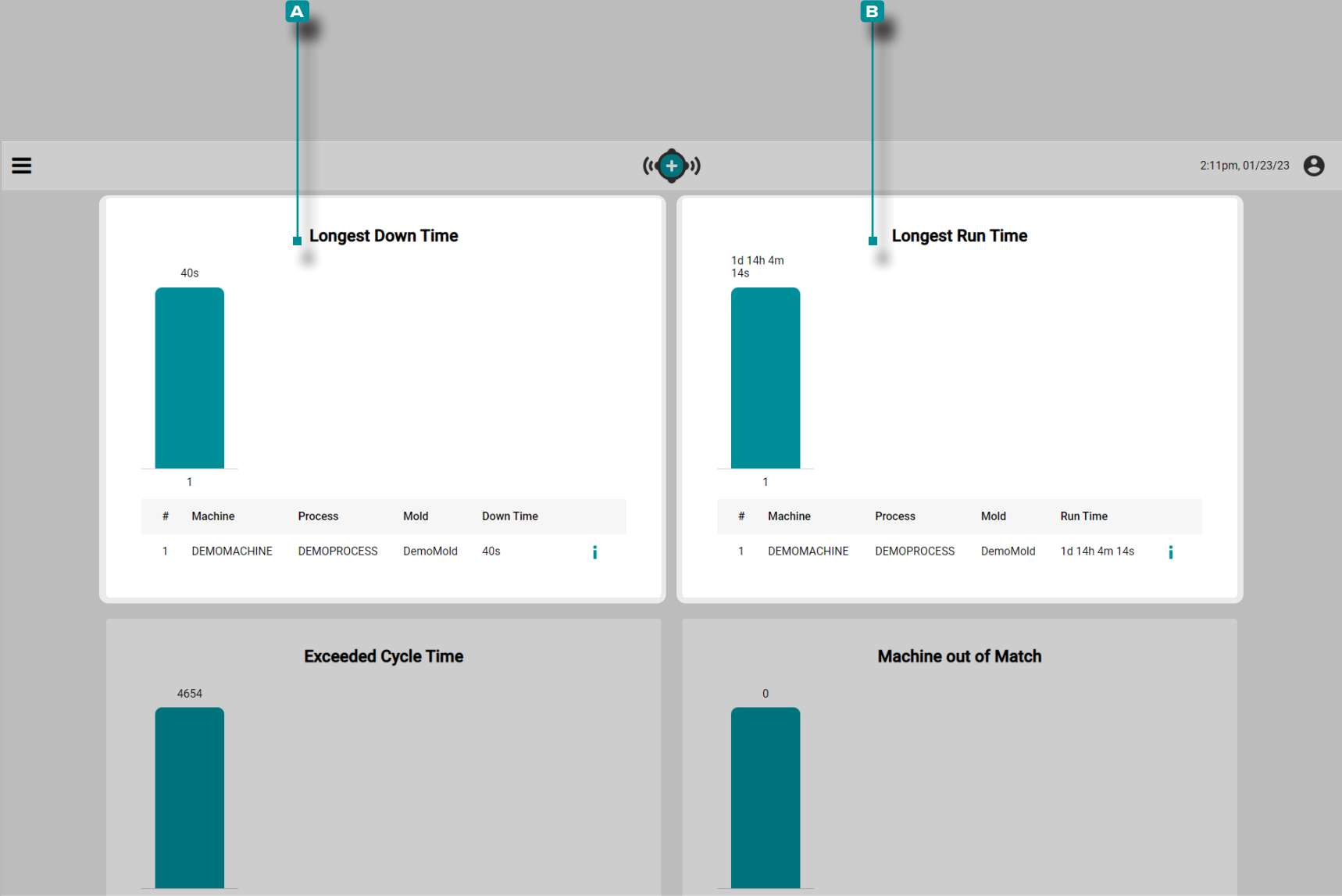
Most Alarms Table

The **A** **Most Alarms** table provides a table view of each job that has been active within the selected timeframe, and lists the machine name, process name, mold name, and total alarms for each job.

Most Warnings

The **B** **Most Warnings** table provides a table view of each job that has been active within the selected timeframe, and lists the machine name, process name, mold name, and warning alarms for each job.

The Hub for Process Monitoring



Longest Down Time Table

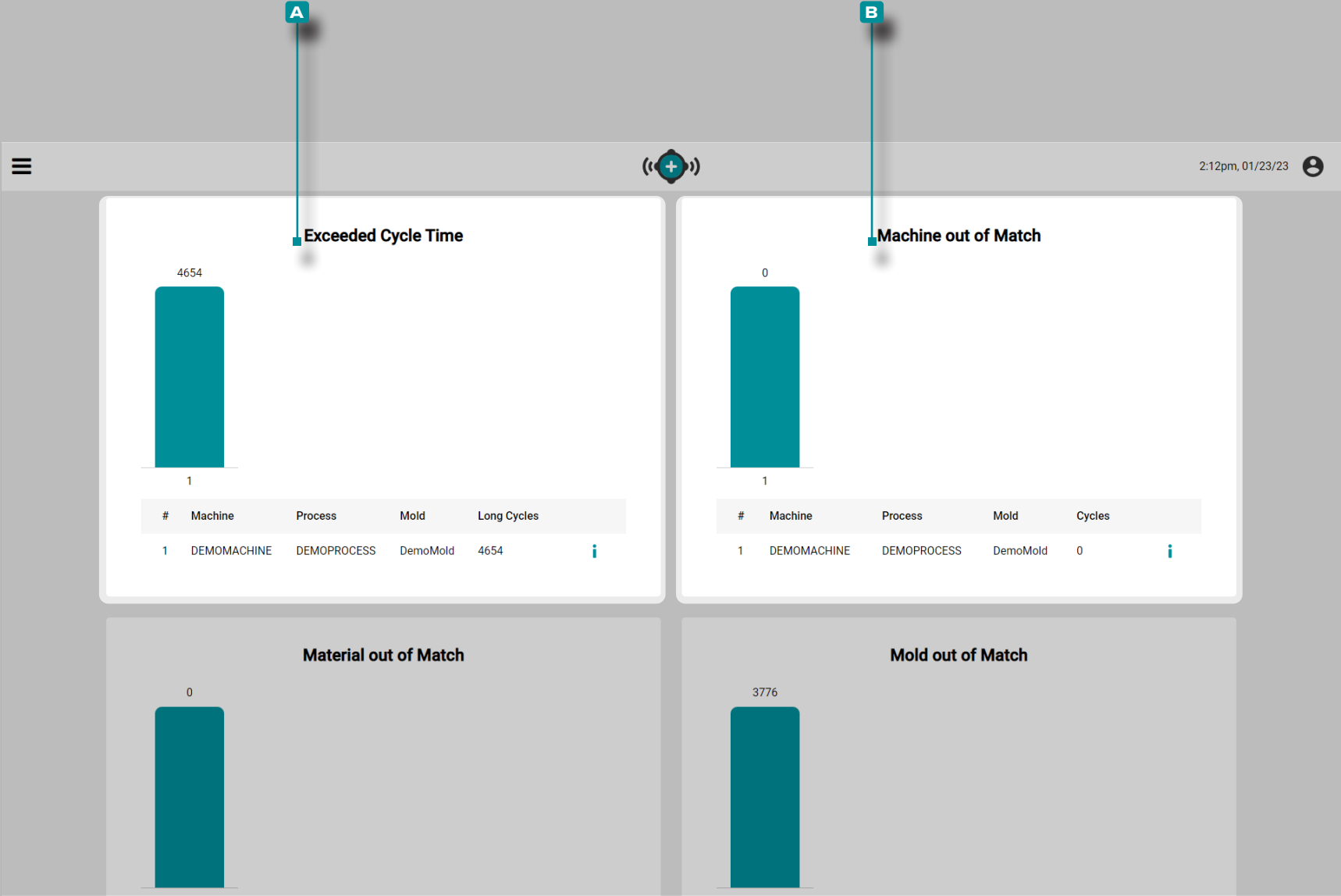
The **A** Longest Down Time table provides a table view of each job that has been active within the past 24 hours, and lists the machine name, process name, mold name, and total down time.

DEFINITION is the length of time a machine is idle while a job is running. is the length of time a machine is down over the duration of a job, measured in hours, minutes, and seconds, or days.

Longest Run Time Table

The **B** Longest Run Time table provides a table view of each job that has been active within the selected timeframe, and lists the machine name, process name, mold name, and the longest run time for each job.

The Hub for Process Monitoring



(Dashboard Tables, *continued*)

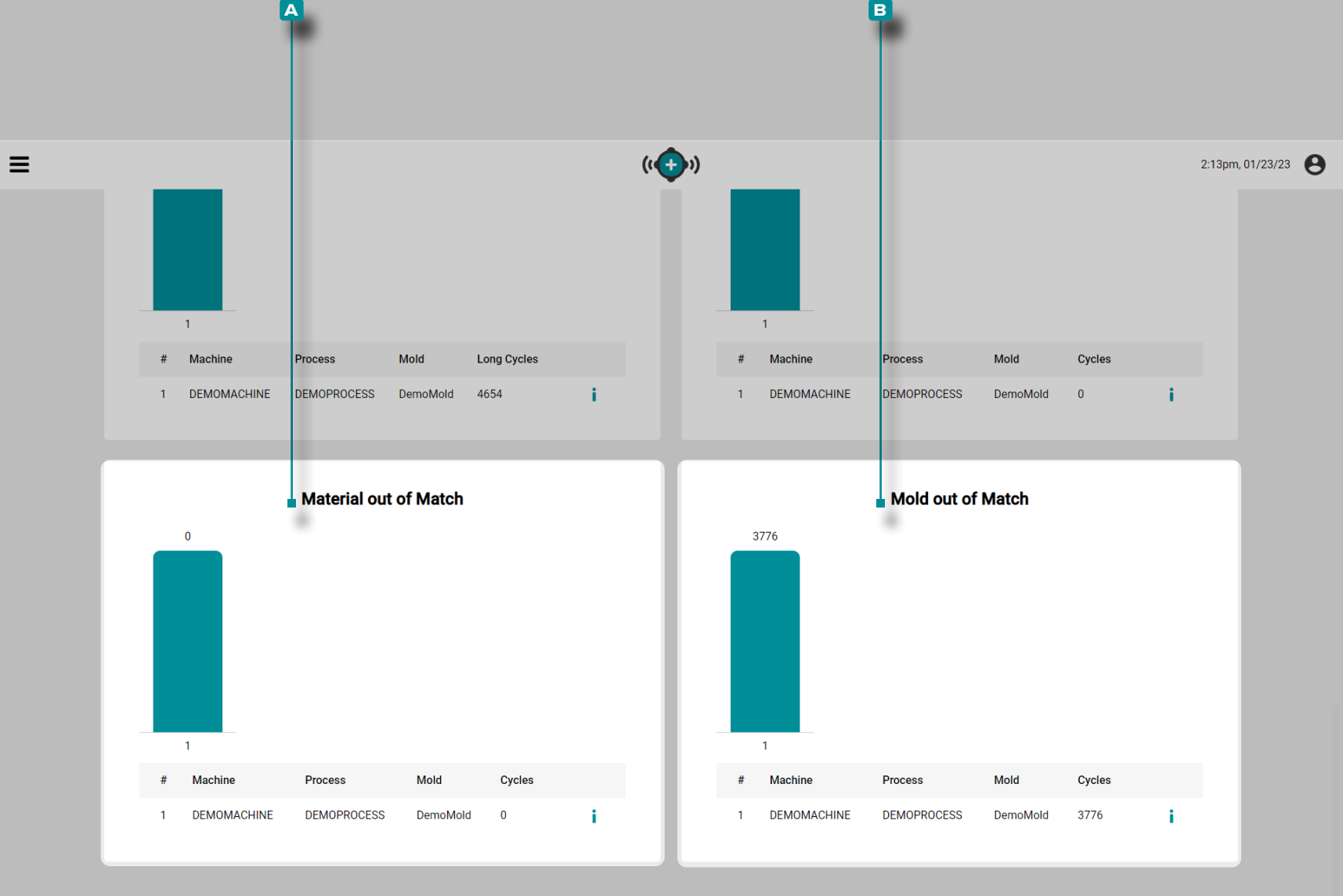
Exceeded Cycle Time Table

The **A Exceeded Cycle Time** table provides a table view of each job that has been active within the selected timeframe, and lists the machine name, process name, mold name, and the number of long cycles (cycles which exceeded the cycle time) for each job.

Machine Out of Match Table

The **B Machine Out of Match** table provides a table view of each job that has been active within the selected timeframe, and lists the machine name, process name, mold name, and total out-of-match machine cycles for each job.

The Hub for Process Monitoring



(Dashboard Tables, *continued*)

Material Out of Match Table

The **B** [Material Out of Match](#) table provides a table view of each job that has been active within the selected timeframe, and lists the machine name, process name, mold name, and total out-of-match material cycles for each job.


Mold Out of Match Table

The **B** [Mold Out of Match](#) table provides a table view of each job that has been active within the selected timeframe, and lists the machine name, process name, mold name, and total out-of-match mold cycles for each job.

The Hub for Process Monitoring

Machines

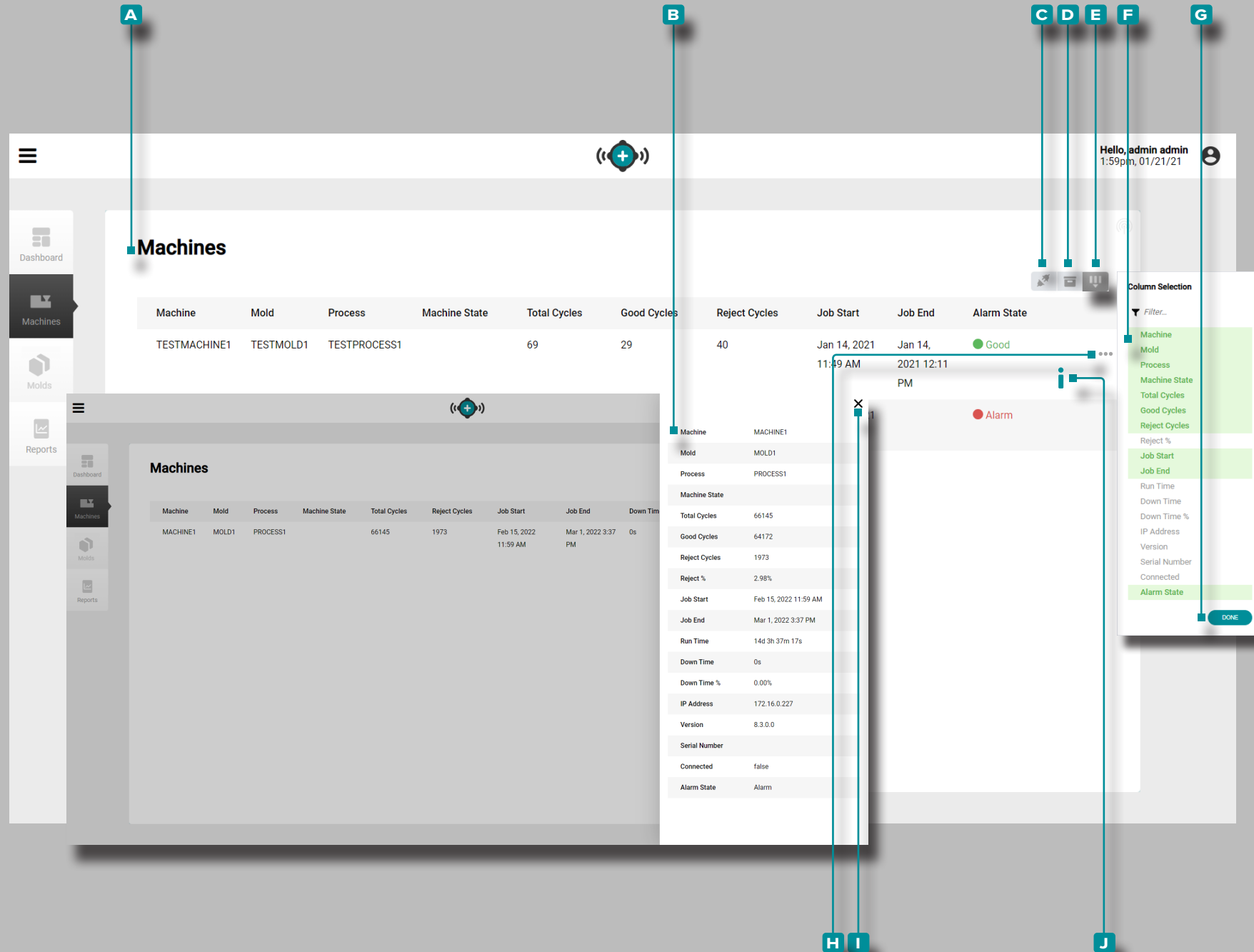
The **A Machines** view provides details of each machine in the network, and a **B detailed machines view**.

The Machines view displays running machines by default; to view all networked machines including stopped, down, or disconnected machine, **Click** the  **connected machines** icon to display all networked machines.

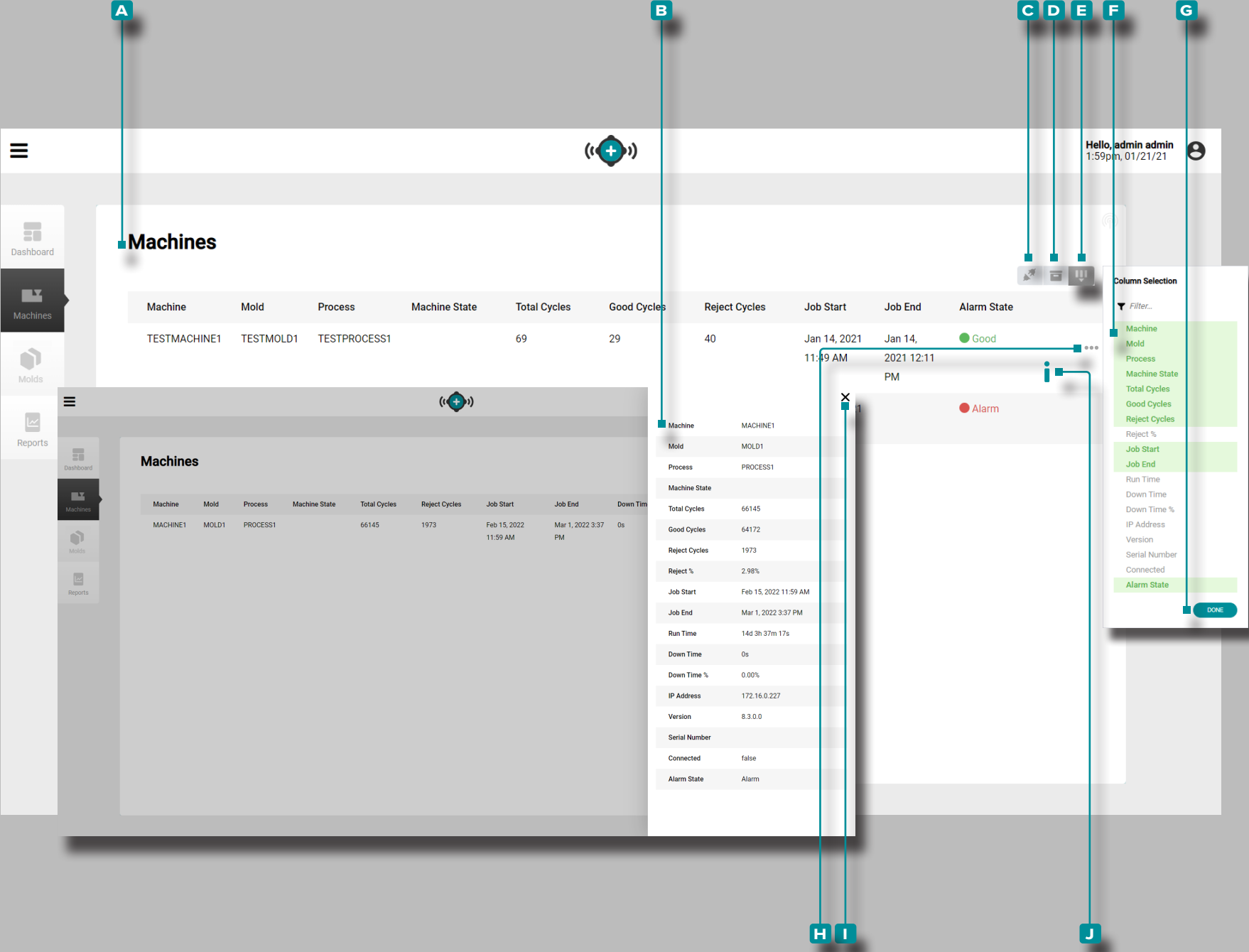
The Machines view can displays the following machine, mold, and job variables:

- Alarm State
- Connected (Yes/No)
- Custom Fields
- Down Time
- Down Time Percent (%)
- Good Cycles
- IP Address
- Job Start
- Job End
- Machine Match
- Machine Name
- Machine State
- Material Match
- Mold Match
- Mold Name
- Out of Match Cycles
- Process Name
- Reject Percent (%)
- Reject Cycles
- Run Time
- Serial Number
- Template
- Total Cycles
- Warning Cycles
- Version

(continued on next page)



The Hub for Process Monitoring



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Click the **D archived records** button to view records that have been archived.

Click the **E Select Columns** to choose the displayed **F variables**. Click the **G DONE** button to save changes and exit the Select Columns pop-up window.

Detailed Machine View

The Detailed Machine View displays all of the machine, mold, and job variables in a single slide-out window.

Click the **H expand information icon** next to the machine name/row to view the slide-out detailed machine view; click the **I exit icon** to close the slide-out detailed machine view.

Click the **J information icon** next to the machine name/row to open the job overview report.

The Hub for Process Monitoring

Molds

The **A Molds** view provides an overview of all jobs for each mold; from the molds view select multiple jobs ran with the mold to overview of the jobs.

Click **B** on a mold name to select the mold.

Jobs

The **C Jobs** view provides an overview of all jobs associated with the selected mold. Click **D** on job names to select multiple jobs ran on the mold, then click the **E Generate Report** button to view a **F Multiple Jobs Overview** of all the selected jobs for the mold.

Multi[ple]-Jobs Report

The Multi[ple]-Jobs Report for multiple jobs displays the following:

- combined jobs cycle values,
- combined jobs alarm events, and
- combined jobs summary graph data trends.

The Multi[ple]-Jobs Report for multiple jobs does not display the following:

- audit report,
- statistics report,
- quality report, or
- work orders.

The screenshot displays the process monitoring interface with several key components labeled A through F:

- A Molds**: The left sidebar menu showing the 'Molds' section.
- B**: A mold name (e.g., 'MOLD3') in the list, which is clicked to select the mold.
- C**: The 'JOBS' tab in the 'Mold: MOLD3' view, which displays a table of jobs.
- D**: A job name in the 'JOBS' table, which is clicked to select multiple jobs.
- E**: The 'GENERATE REPORT' button in the 'Multi-Job Report: Overview' view.
- F**: The 'Multiple Jobs Overview' view, which displays a summary of the selected jobs.

The 'JOBS' table in the 'Mold: MOLD3' view contains the following data:

Machine	Process	Total Cycles	Good Cycles	Reject Cycles	Out of Match Cycles	Job Start	Job End	Down Time
KDAWGSMACHINE	TESTPROCESS	122	122	0	1	2024-02-09 09:50:26	2024-02-09 10:28:19	0s
KDAWGSMACHINE	TESTPROCESS	35	35	0	0	2024-02-08 15:41:17	2024-02-08 15:52:57	40s
KDAWGSMACHINE	TESTPROCESS	83	83	0	0	2024-02-08 15:04:21	2024-02-08 15:30:21	0s

The 'Multi-Job Report: Overview' view displays the following summary:

Machine	KDAWGSMACHINE	Mold	MOLD3	Process	TESTPROCESS
Standard Cycle Time	23s	Run Time	1h 15m 32s	Down Time	41s
Job Start	2024-02-08 15:04:21	Job End	2024-02-09 10:28:19	Template	-

The 'CYCLES' section shows:

Total	Good	Reject
240	240	0

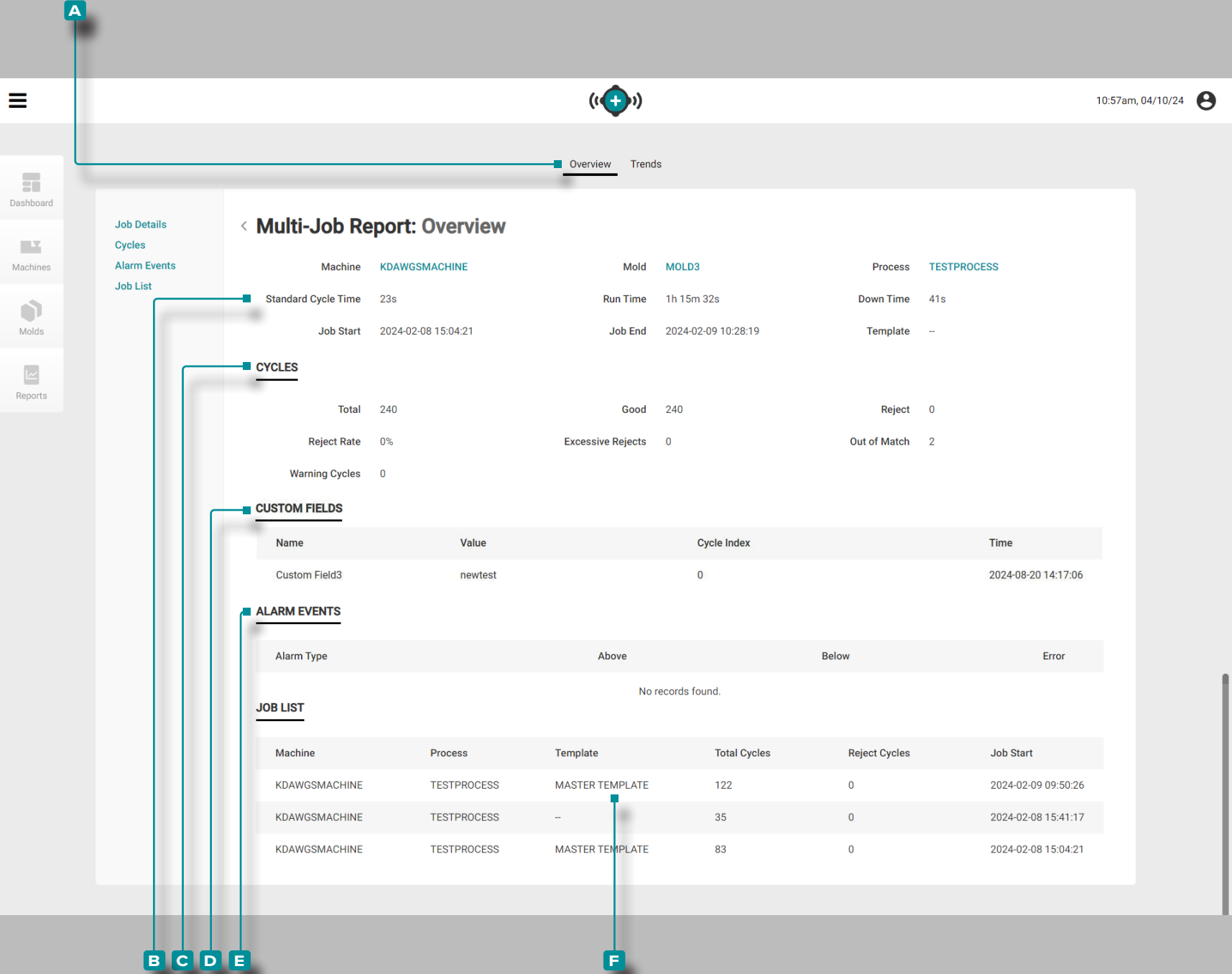
The 'ALARM EVENTS' section shows:

Alarm Type	Above	Below	Error
No records found.			

The 'JOB LIST' section shows:

Machine	Process	Template	Total Cycles	Reject Cycles	Job Start
KDAWGSMACHINE	TESTPROCESS	MASTER TEMPLATE	122	0	2024-02-09 09:50:26
KDAWGSMACHINE	TESTPROCESS	-	35	0	2024-02-08 15:41:17
KDAWGSMACHINE	TESTPROCESS	MASTER TEMPLATE	83	0	2024-02-08 15:04:21

The Hub for Process Monitoring



Multi[ple]-Jobs Report: Overview

The **A Multi[ple] Jobs Report: Overview** provides machine, process, mold, and job information including **B Job Details**, **C Cycles** count, **D Custom Fields**, **E Alarm Events**, and **F Job List**.

All values displayed in the Multi[ple]-Jobs Report: Overview are the combined total for the selected jobs.

The **B Job Details** displays the machine, mold, process, and template names, as well as total run time, job start date/time, and job end date/time.

The **C Cycles** count displays the number of total, good, reject, and out of match cycles in the job, along with the reject rate (%) percent, excessive rejects count, and out of match count.

The **D Custom Fields** displays the job's custom fields.

The **E Alarm Events** displays the job's alarm state (no alarm/ alarm), total alarms, and any alarms by type with the above or below values.

The **F Job List** displays selected jobs at the bottom of the report.

The Hub for Process Monitoring

Multi[ple]-Jobs Report: Trends

The **A Multi[ple] Jobs Report: Trends** provides summary and cycle graphs. The summary graph provides the selection and graphical display of **B job cycle data types** over the length of the job which form **C trends**, and additionally highlights alarm conditions which occurred.

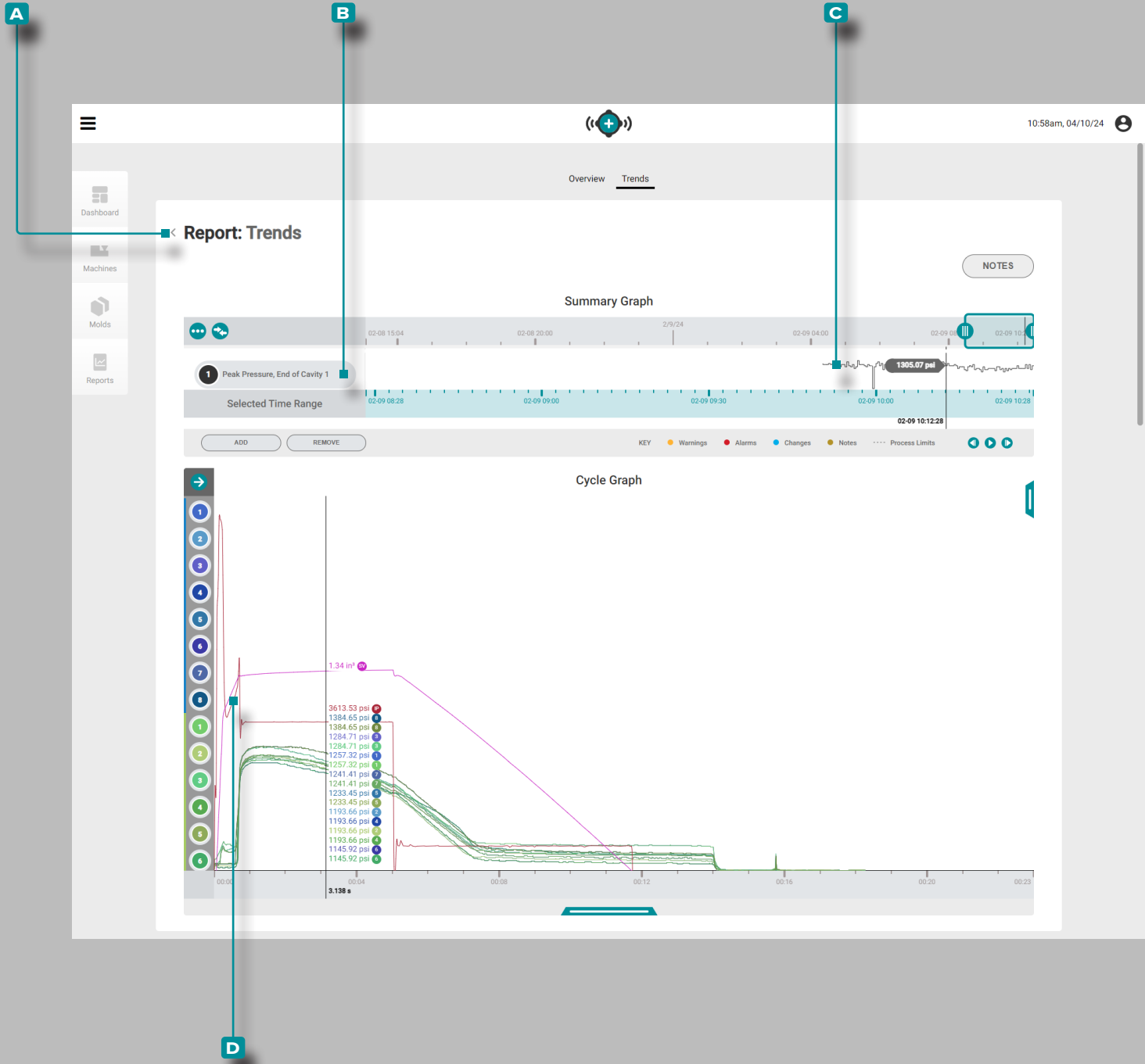
The trends are formed by cycle summary values; a single data point represents a cycle. Data points are displayed together, creating a curve and allowing the viewing of trends.

The cycle graph provides the selection and graphical display of **D job cycle curves**. Each **D job cycle curve** provides Lynx device input, machine sequence, or cavity pressure/temperature sensor cycle data to view or print on the cycle graph.

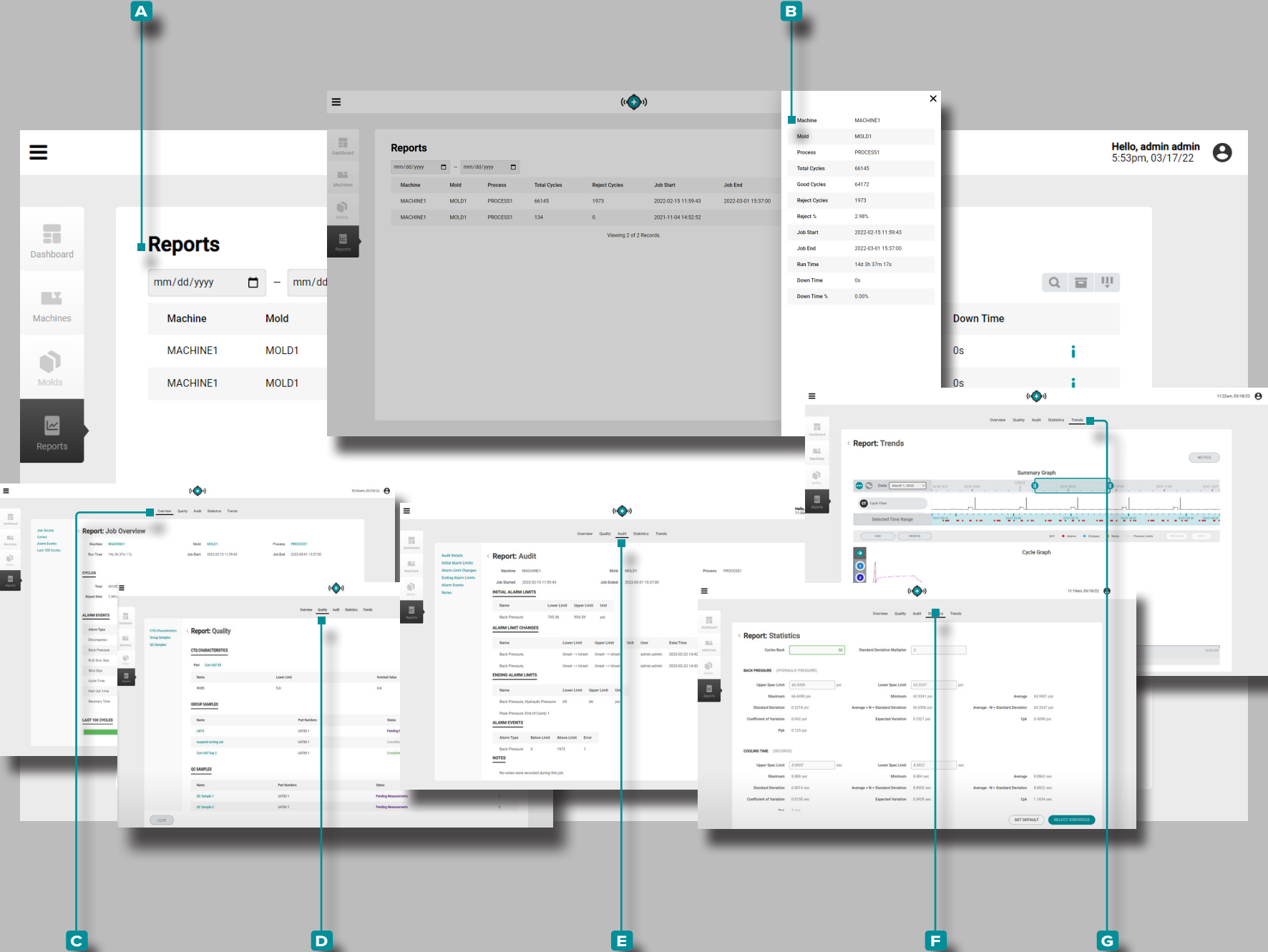
The type and number of **B job cycle data types** **C trends** and **D job cycle curves** available depends upon connected machine and equipment.

Additionally, users may export multiple jobs from the summary graph (multiple .csv files contained in a .zip folder); the export will start at the start date/time of the first job and end at the end date/time of the last job. The user may select whether to export the selected trends or all trends, and whether to include part measurements.

For all summary and cycle graph controls, and for job exports, refer to page 21–page 29.



The Hub for Process Monitoring



Reports

The **A** Reports view provides a customizable view of machine, mold, and process details of each networked machine, a **B** detailed reports view, and access to **C** Job Overview, **D** Quality, **E** Audit, **F** Statistics, and **G** Trends reports for each job.

(continued on next page)

The Hub for Process Monitoring

(continued from previous page)

(Reports, continued)

The **A Reports** view displays the following machine, mold, and job variables:

- Machine Name
- Mold Name
- Process Name
- Total Cycles
- Good Cycles
- Reject Cycles
- Reject Percent (%)
- Warning Cycles
- Out of Match Cycles
- Template
- Job Start
- Job End
- Run Time
- Down Time
- Down Time Percent (%)
- Custom Fields

Click **B** the **search** icon to enter/search for a word or phrase among the reports.

Click **C** the **archive** icon to display archived reports in the listed reports.

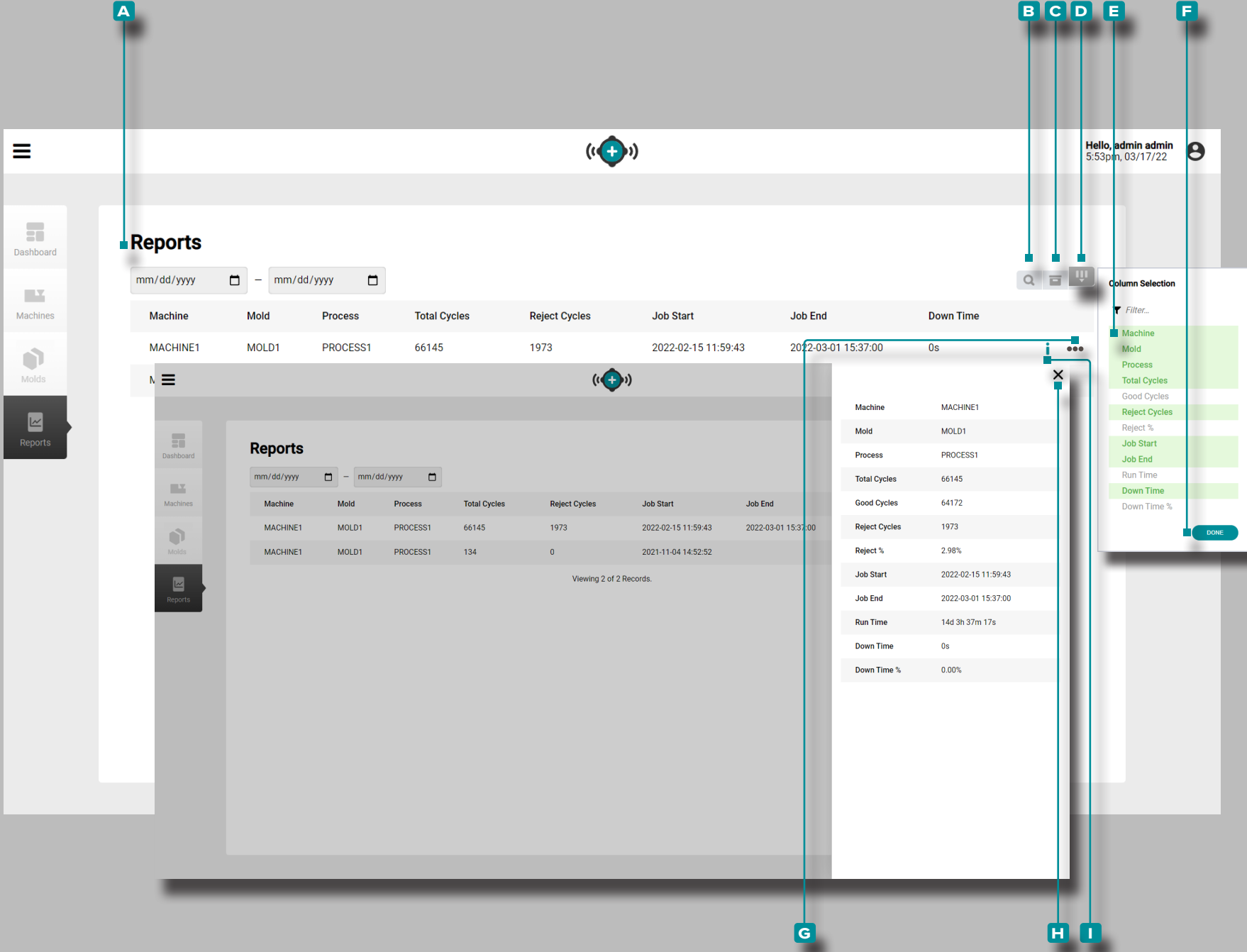
Click **D** **Select Columns** to choose the displayed **E variables**. Click **F** the **DONE** button to save changes and exit the Select Columns pop-up window.

Detailed Report View

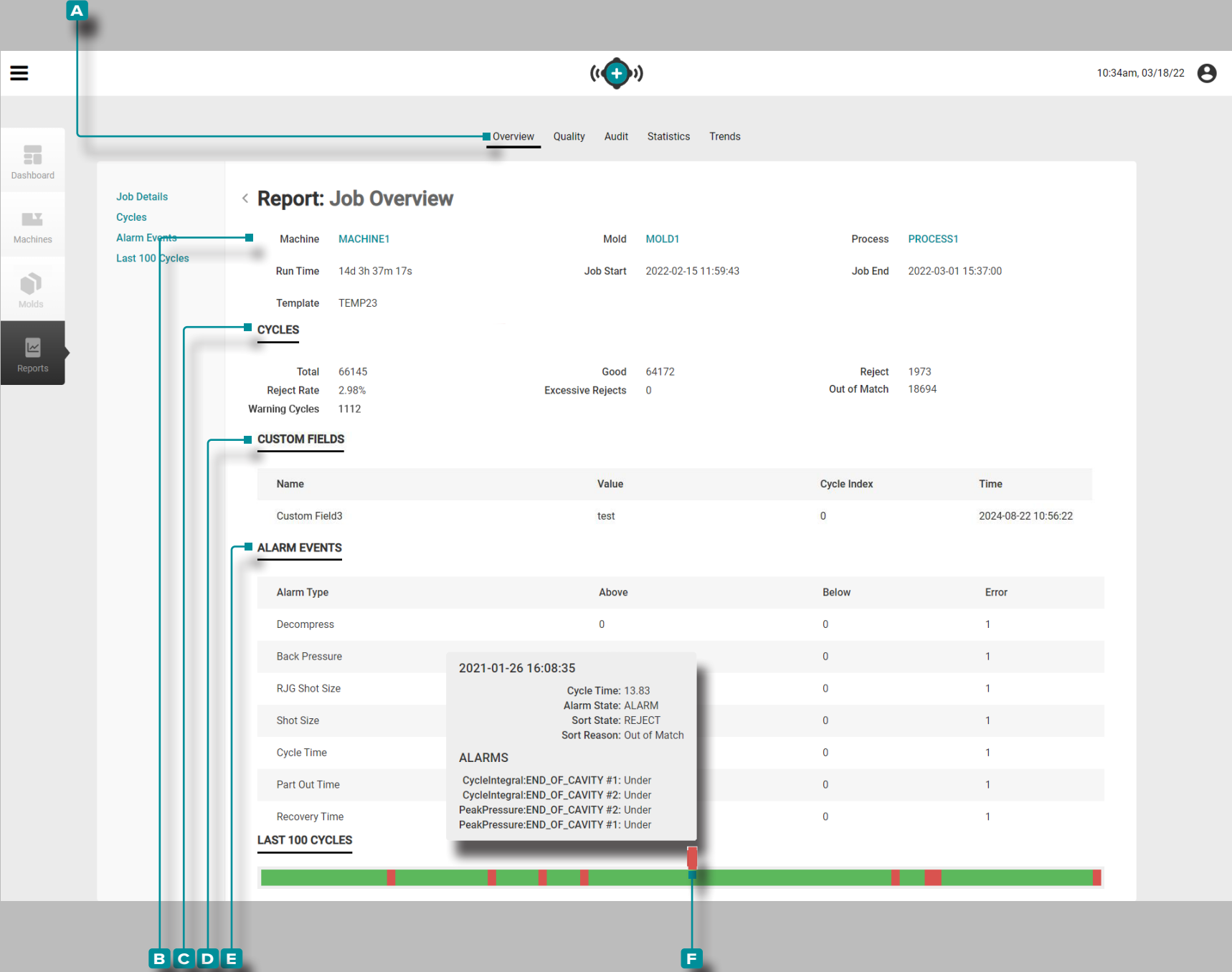
The Detailed Report View displays all of the 12 machine, mold, and job variables in a single slide-out window.

Click **G** the **expand information icon** next to the machine name/row to view the slide-out detailed machine view; click the **H** **exit icon** to close the slide-out detailed machine view.

Click **I** the **information icon** next to the machine name/row to open the job overview report (refer to "Reports: Job Overview" on page 16 for more information).



The Hub for Process Monitoring



Reports: Job Overview

The **A Job Overview** report provides machine, process, mold, and job information including **B Job Information**, **C Cycles** count, **D Custom Fields**, and **E Alarm Events** the **F History** bar.

The **B Job Information** displays the machine, mold, process, and template names, as well as total run time, job start date/time, and job end date/time.

The **C Cycles** count displays the number of total, good, reject, and out of match cycles in the job, along with the reject rate (%) percent, excessive rejects count, and out of match count.

The **D Custom Fields** displays the job's custom fields.

The **E Alarm Events** displays the job's alarm state (no alarm/ alarm), total alarms, and any alarms by type with the above or below values.

Mouse over the Job Details **F History** bar to view cycle details including cycle start date and time, cycle time (length of cycle), cycle alarm/warning state, cycle sort state, and alarm occurrences.

The Hub for Process Monitoring

Dashboard

Machines

Molds

Reports

Overview

Quality

Audit

Statistics

Trends

CTQ Characteristics

Group Samples

QC Samples

< Report: Quality

CTQ CHARACTERISTICS

Part Curt UAT 83

Name	Lower Limit	Nominal Value	Upper Limit
Width	5 in	6 in	7 in

GROUP SAMPLES

Name	Part Numbers	Status	Cycles
UAT4	UAT83 1	Pending Measurements	2
suspend sorting uat	UAT83 1	Cancelled	4 / 5
Curt UAT Day 2	UAT83 1	Completed	5

QC SAMPLES

Name	Part Numbers	Status	Cycles
QC Sample 1	UAT83 1	Pending Measurements	2
QC Sample 2	UAT83 1	Pending Measurements	2

CLOSE

Reports: Quality

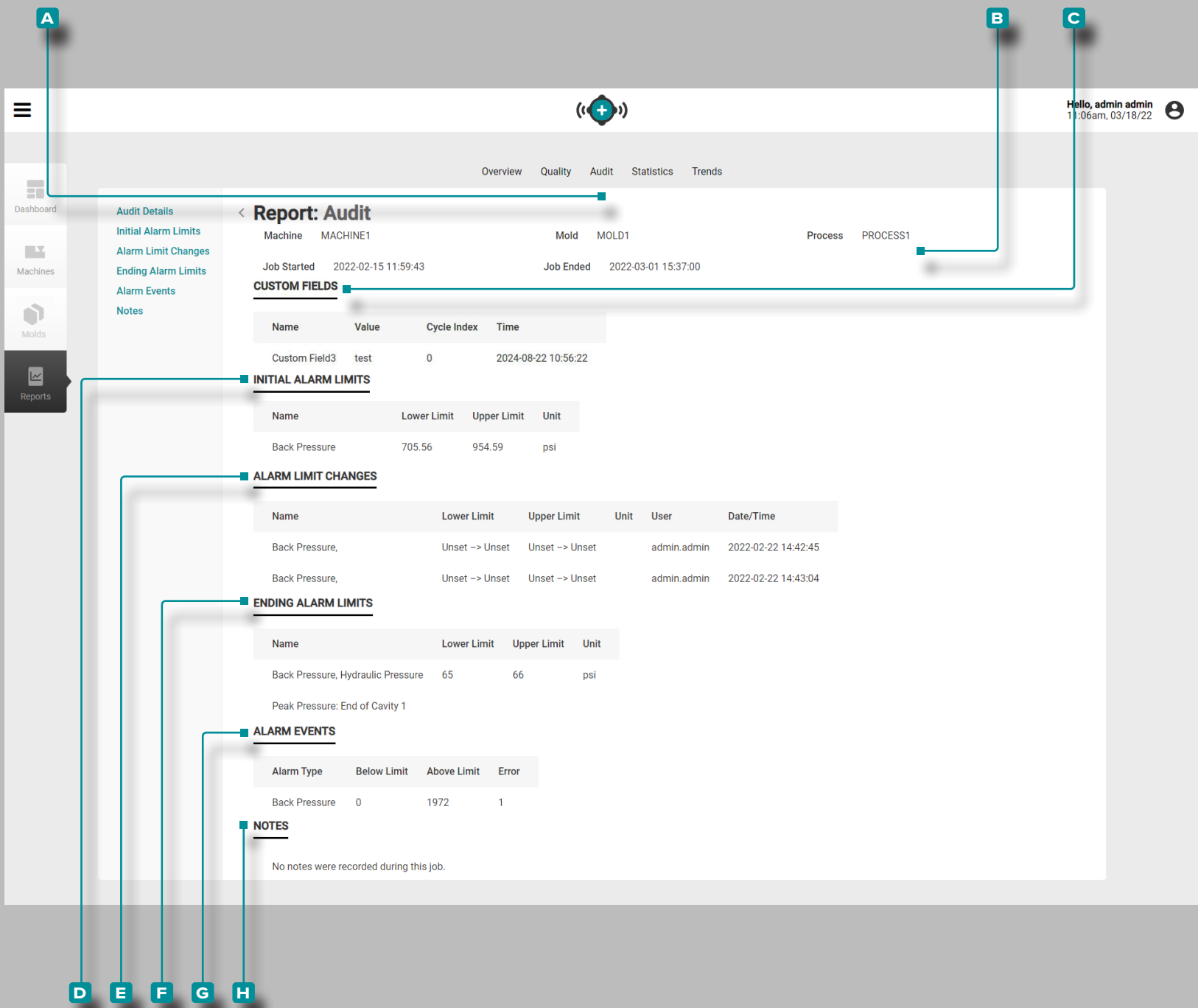
The **A** Quality report provides **B** CTQ Characteristics, **C** Group Samples, and **D** QC Samples for the related job.

The **B** CTQ Characteristics displays the related part and any CTQs for the part.

The **C** Group Samples displays group samples taken during the job, including name, part numbers, status, and number of cycles.

The **D** QC Samples displays QC samples taken during the job, including name, part numbers, status, and number of cycles.

The Hub for Process Monitoring



Reports: Audit

The **A** Audit report provides **B** Job Information including information entered at setup; any **C** Custom Fields used for the job; **D** Initial Alarm Limits including lower and upper limits which were entered for alarms at setup; **E** Alarm Limit Changes made during the job; **F** Ending Alarm Limits including lower and upper limits from the job; **G** Alarm Events which occurred during the job; and **H** Notes entered during the job (including any process match assistance advice notes entered on the CoPilot system). If a process change number was entered with a note, it will appear in the **H** Notes section.

The Hub for Process Monitoring

Reports: Statistics

The **A** **Statistics** report provides a selection and viewing of up to 26 machine or mold variable values with up to 12 statistics displayed for each value.

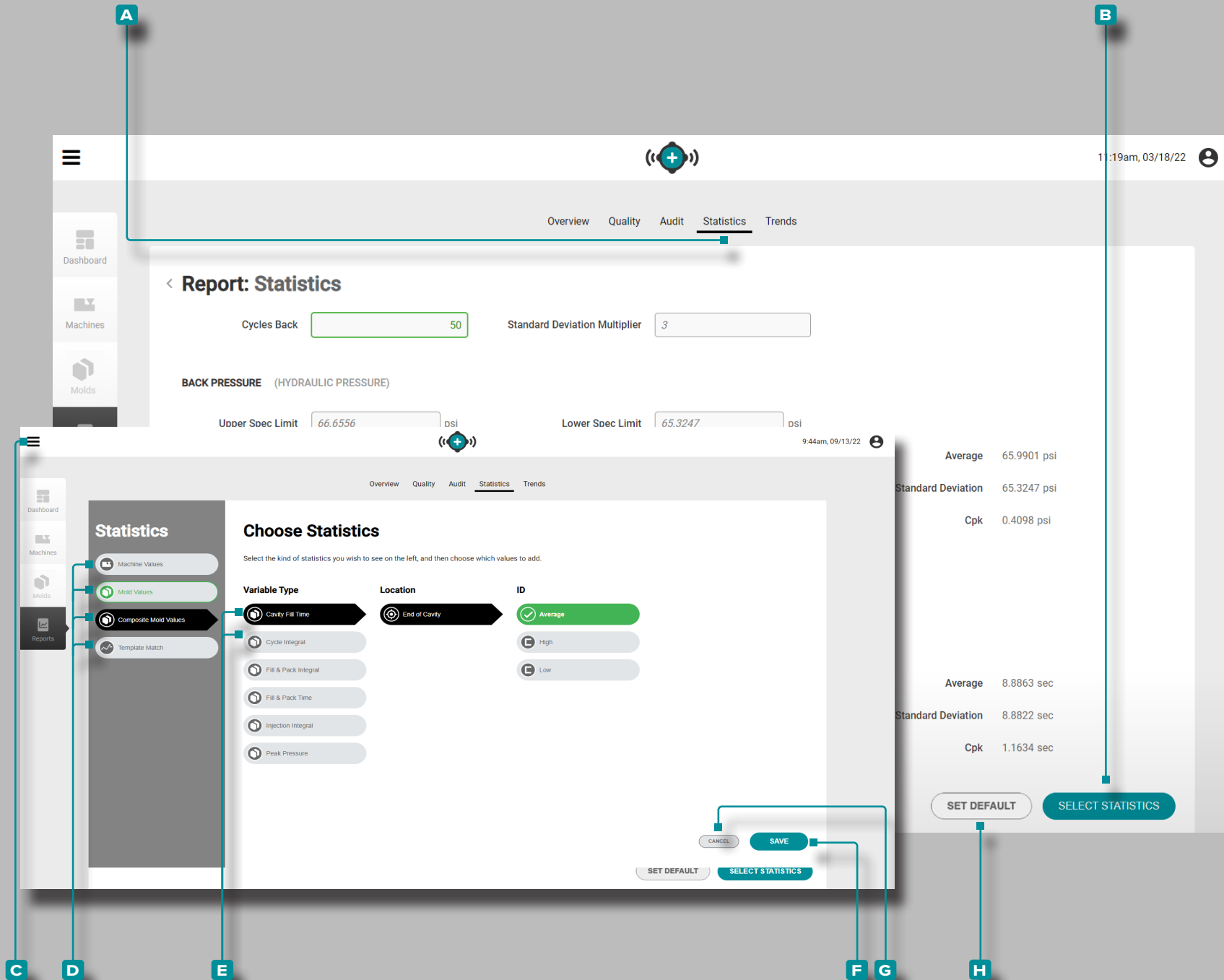
Click the **B** **select statistics** button to view the **C** **choose statistics** window; click a **D** **statistic values type** (machine, mold, composite mold, or template values), then click to select each desired **E** **variable type, location, Quantity, and ID** (if necessary), then click the **F** **SAVE** button to save the selections, or the **G** **cancel** button to cancel the selections.

Click the **H** **set default** button to save selections across sessions for the selected process.

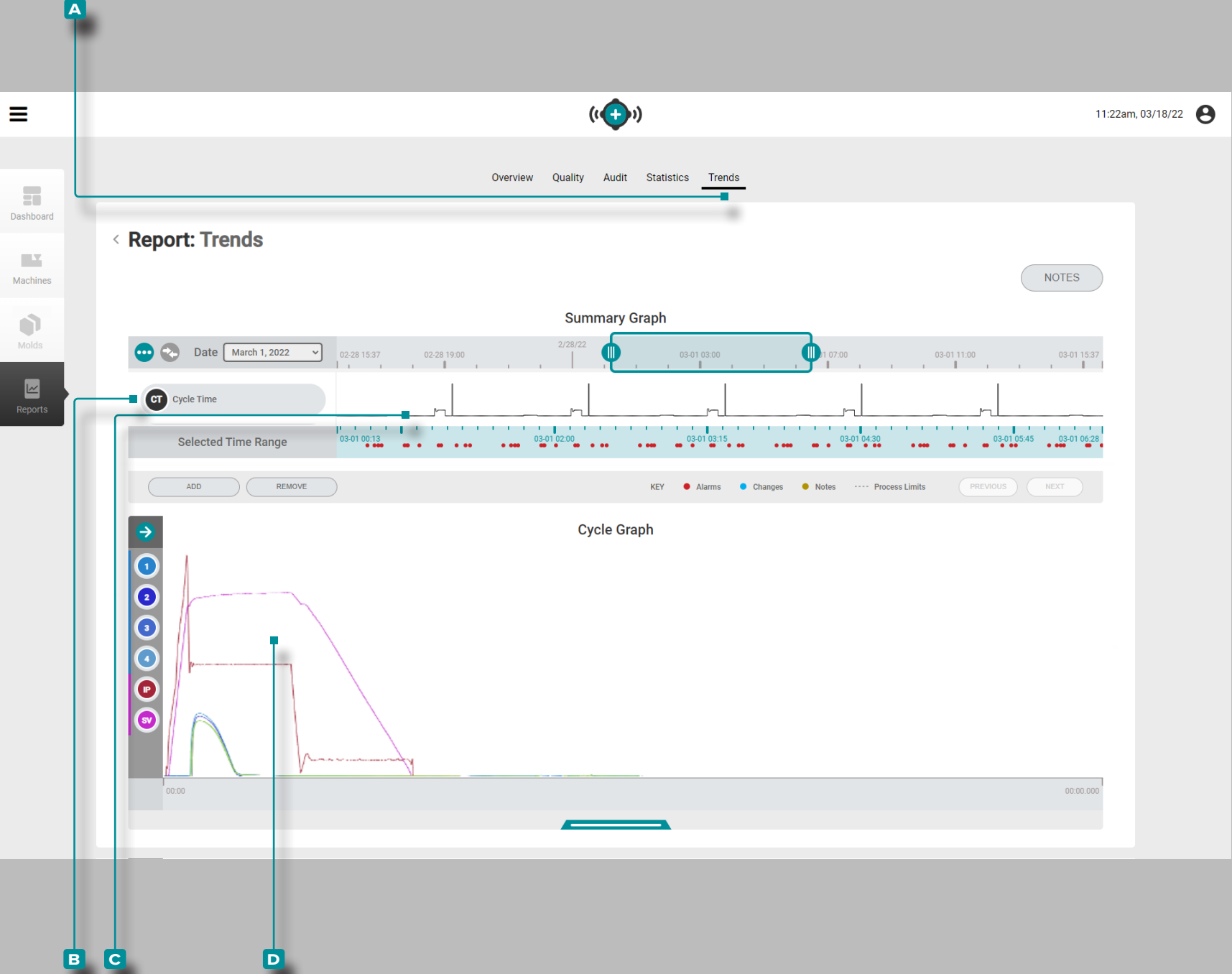
If desired, enter the number of cycles back from the total cycles from which data will be retrieved; a standard deviation multiplier is automatically entered, but also may be changed.

The following statistics are displayed beneath each chosen statistic variable type:

- Upper Spec Limit
- Lower Spec Limit
- Maximum
- Minimum
- Average
- Standard Deviation
- Average + N * Standard Deviation
- Average - N * Standard Deviation
- Coefficient of Variation
- Expected Variation
- Cpk (process capability measurement)
- Ppk (process performance index)



The Hub for Process Monitoring



Reports: Trends

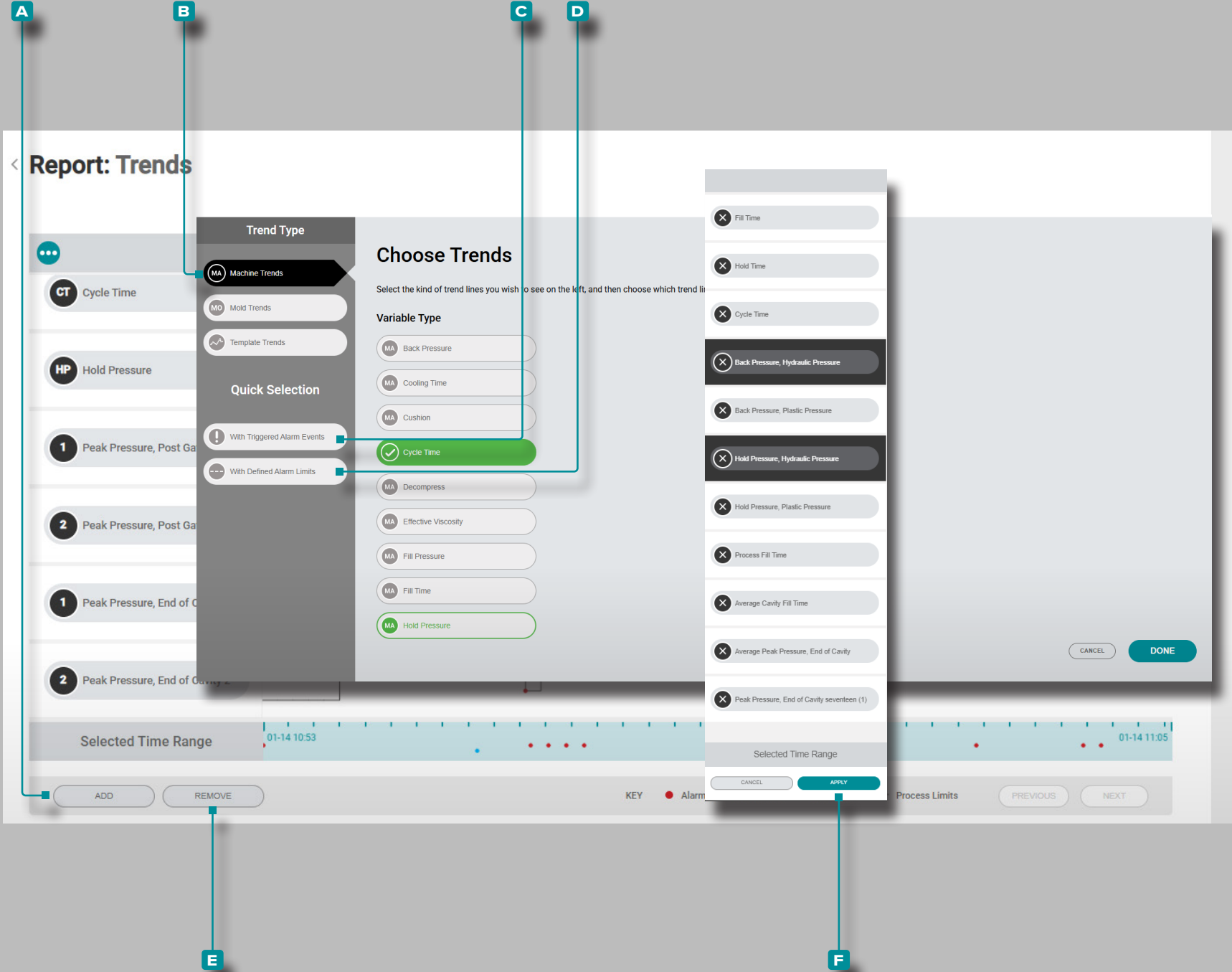
The **A trends** report provides summary and cycle graphs. The summary graph provides the selection and graphical display of **B job cycle data types** over the length of the job which form **C trends**, and additionally highlights alarm conditions which occurred.

The trends are formed by cycle summary values; a single data point represents a cycle. Data points are displayed together, creating a curve and allowing the viewing of trends.

The cycle graph provides the selection and graphical display of **D job cycle curves**. Each **D job cycle curve** provides Lynx device input, machine sequence, or cavity pressure/temperature sensor cycle data to view or print on the cycle graph.

The type and number of **B job cycle data types** **C trends** and **D job cycle curves** available depends upon connected machine and equipment.

The Hub for Process Monitoring



Add or Remove Summary Graph Trends

Add Summary Graph Trends

To select and view additional Trends, **click** the **A** add button, then **click** **B** machine trends, mold trends, composite mold trends, or template trends. **click** the desired trend variable type from the list and then **click** the done; the selected trend(s) will be added to the summary graph.

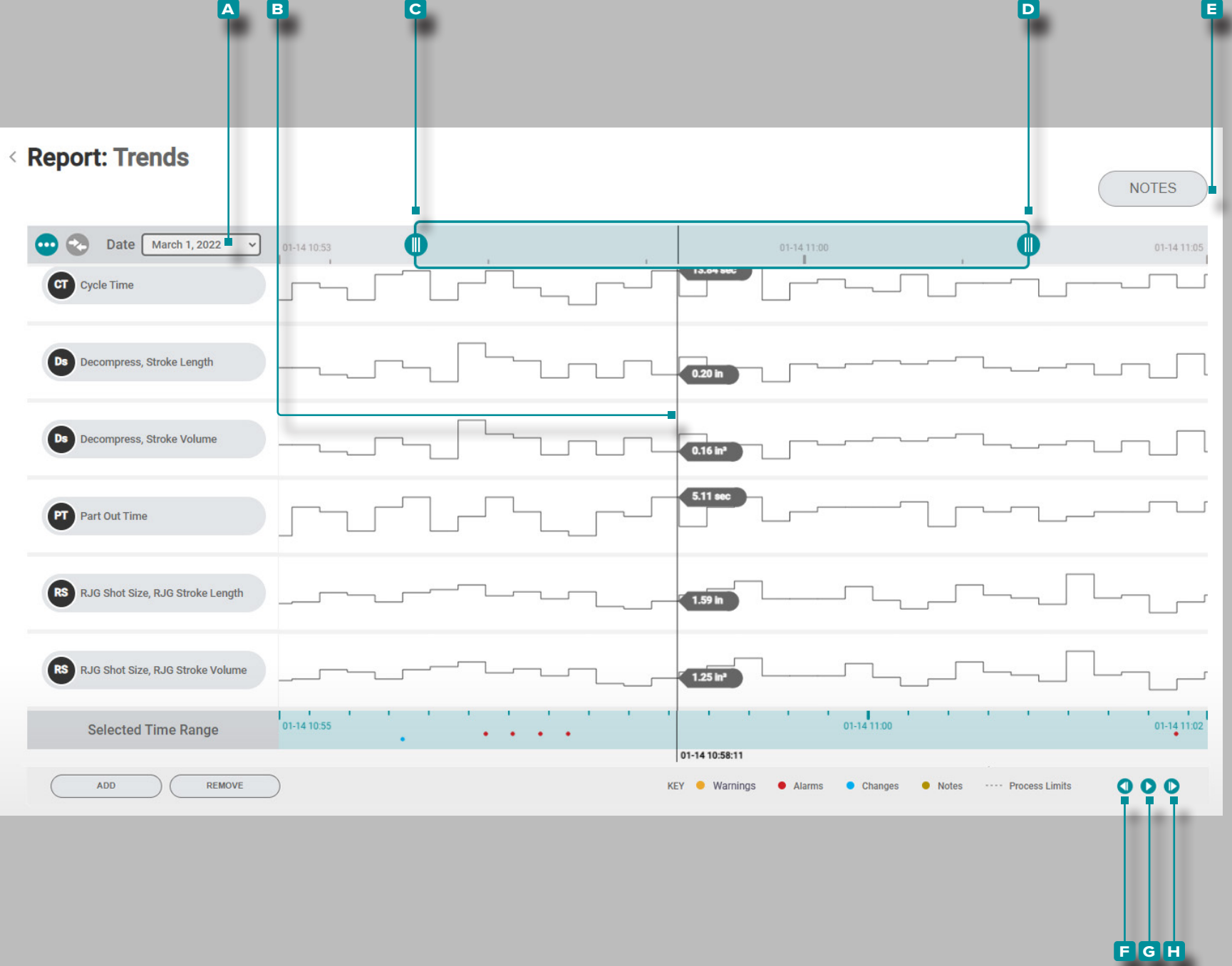
Add Summary Graph Trends with Alarms or Limits

To view trends with alarm or limits, **click** the **C** with triggered alarm events or **D** with defined alarm limits buttons. The affected trends will display—alarms are denoted on the trend line by a red dot.

Remove Summary Graph Trends

To remove Trends, **click** the **E** remove button, **click** to select a trend or trends, and then **click** the **F** apply button to dismiss the trend(s).

The Hub for Process Monitoring



Summary Graph Trend Controls

Select Date

Click **A** on the drop-down menu, then click **A** to select a date to view data for a specific day.

Select a Data Point/Show Cursor

Click **B** and hold on a data point within the graph to view the cursor, which provides the selected cycle's summary-data point-specific details.

Zoom In or Out

Trends are automatically scaled to show the entire job. Click **C**, hold, and drag the **C & D** graph bars to zoom to or select a desired time period within the job.

Click **C**, hold, and drag between the selected time range between the graph bars to move the zoom area to a different time period.

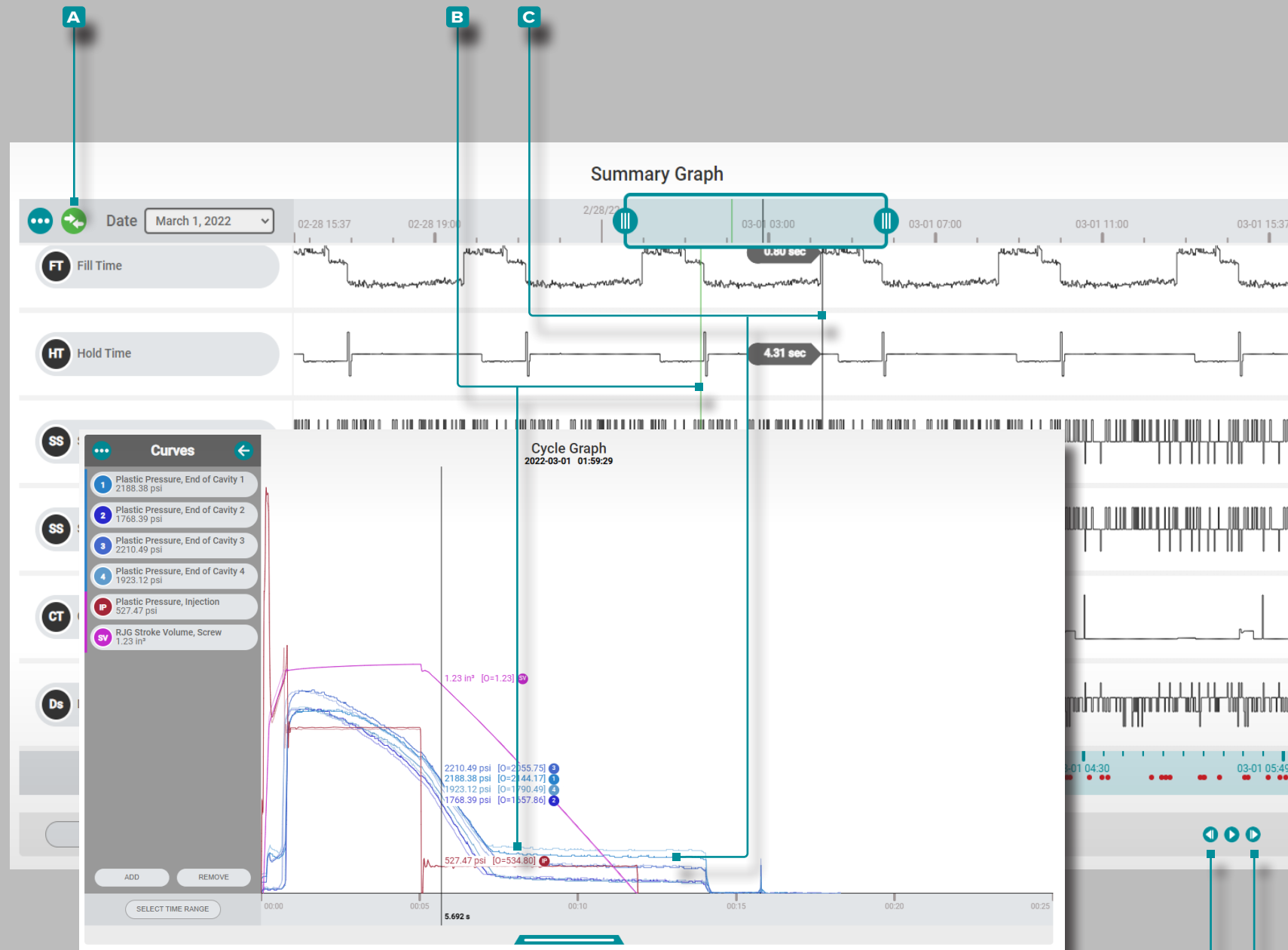
Notes

Click **E** the **NOTES** button to display any notes entered during the job (including any process match assistance advice notes entered on the CoPilot system).

Pan Through Cycles, or Play Cycle-by-Cycle

Click **F** the **previous** button to view the previous cycle, the **G** **play** button to play through the date until the job end, or the **H** **next** button to view the next cycle. The cursor must be selected for these functions to work.

Click **F**, hold, and drag on the summary graph to pan left or right on the graph.



The Hub for Process Monitoring

Comparing Summary Graph Cycles (Comparing Cycles on Cycle Graph)

Two cycles from the Summary Graph can be selected for comparison and displayed on the current Cycle Graph.

Select Cycle for Display/Comparison

Click and **hold** on a data point on the Summary Graph to display the selected cycle and cursor on the cycle graph; the **A compare icon** will be teal. If no cycle is selected for overlay on the Summary Graph, the compare icon will be grey. Tap the **A compare icon**, then **click** and **hold** on another data point to overlay the selected Summary Graph cycles on the Cycle Graph; the **A compare icon** will be green.

Cycle Graph Comparison Cycle Display and Behavior

The **B comparison cycle** appears on the summary graph as a green line, and on the cycle graph as lighter-tinted curves than the **C currently-selected cycle's** curves. The Cycle Graph will display the curves for the **C currently-selected cycle** (cursor/comparison cycle) and **B comparison cycle** from the Summary Graph. The **comparison cycle will remain displayed on the cycle graph until it is cleared**.

Select a Different Cycle for Comparison and Overlay

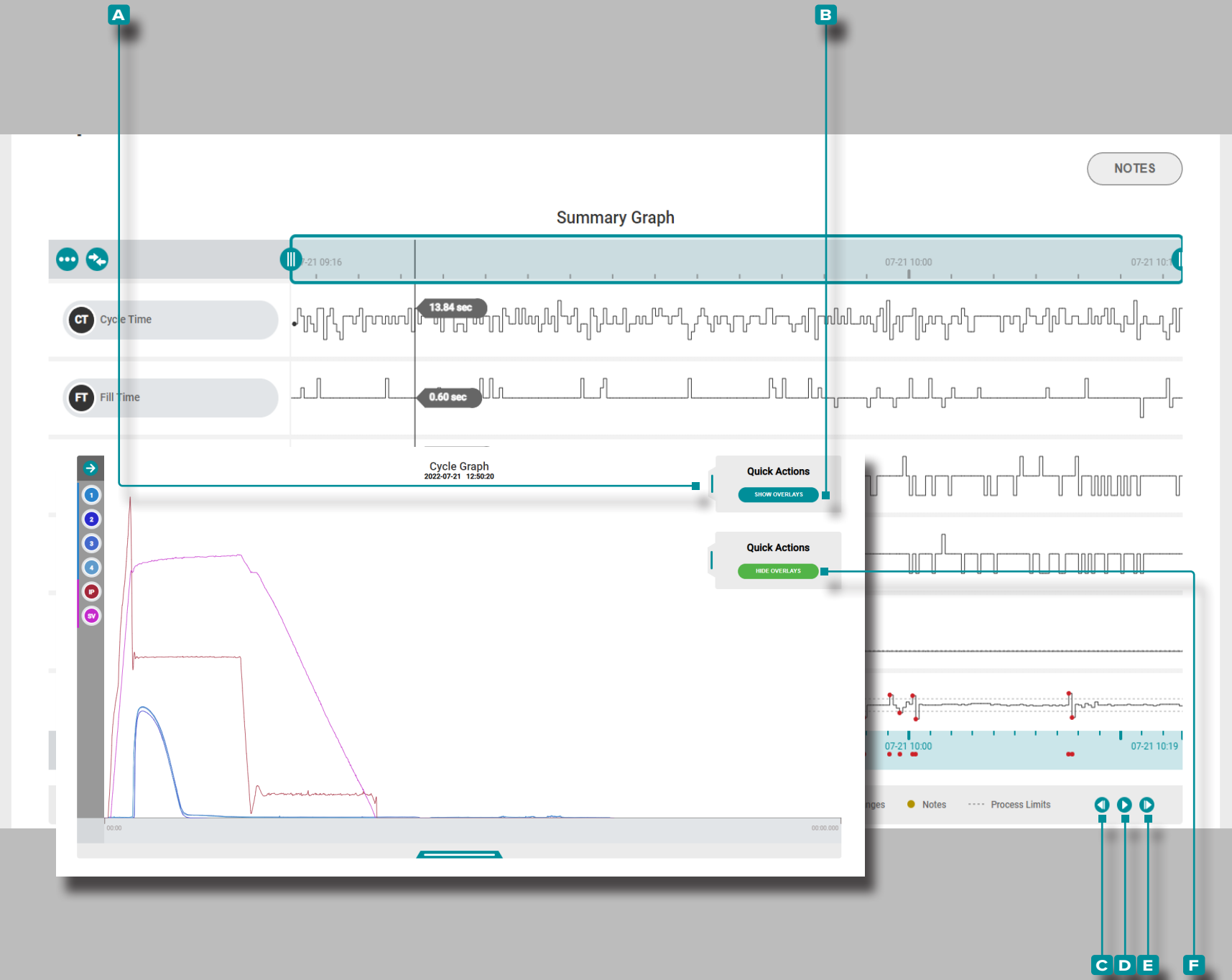
To select a different cycle to compare on the cycle graph, use the **D PREVIOUS** or **E NEXT** buttons to navigate to the desired cycle, OR **click**, **hold**, and **drag** the cursor to the desired cycle. The Cycle Graph will update automatically.

To select a different cycle to compare on the cycle graph, remove the current comparison cycle (see below: "Clear a Comparison Cycle"), then select a new cycle for comparison (see above "Select Cycle for Display/Comparison").

Clear a Comparison Cycle

To remove a comparison cycle, **click** the **A compare icon**; the icon will be teal.

The Hub for Process Monitoring



Overlaying Summary Graph Cycles (Overlaying Cycles on Cycle Graph)

Multiple cycles from the Summary Graph can be overlaid and displayed on the Cycle Graph.

Select and Display Overlay Cycles

Click and **hold** on a data point on the Summary Graph to display the cursor on Summary Graph and the selected cycle on the cycle graph.

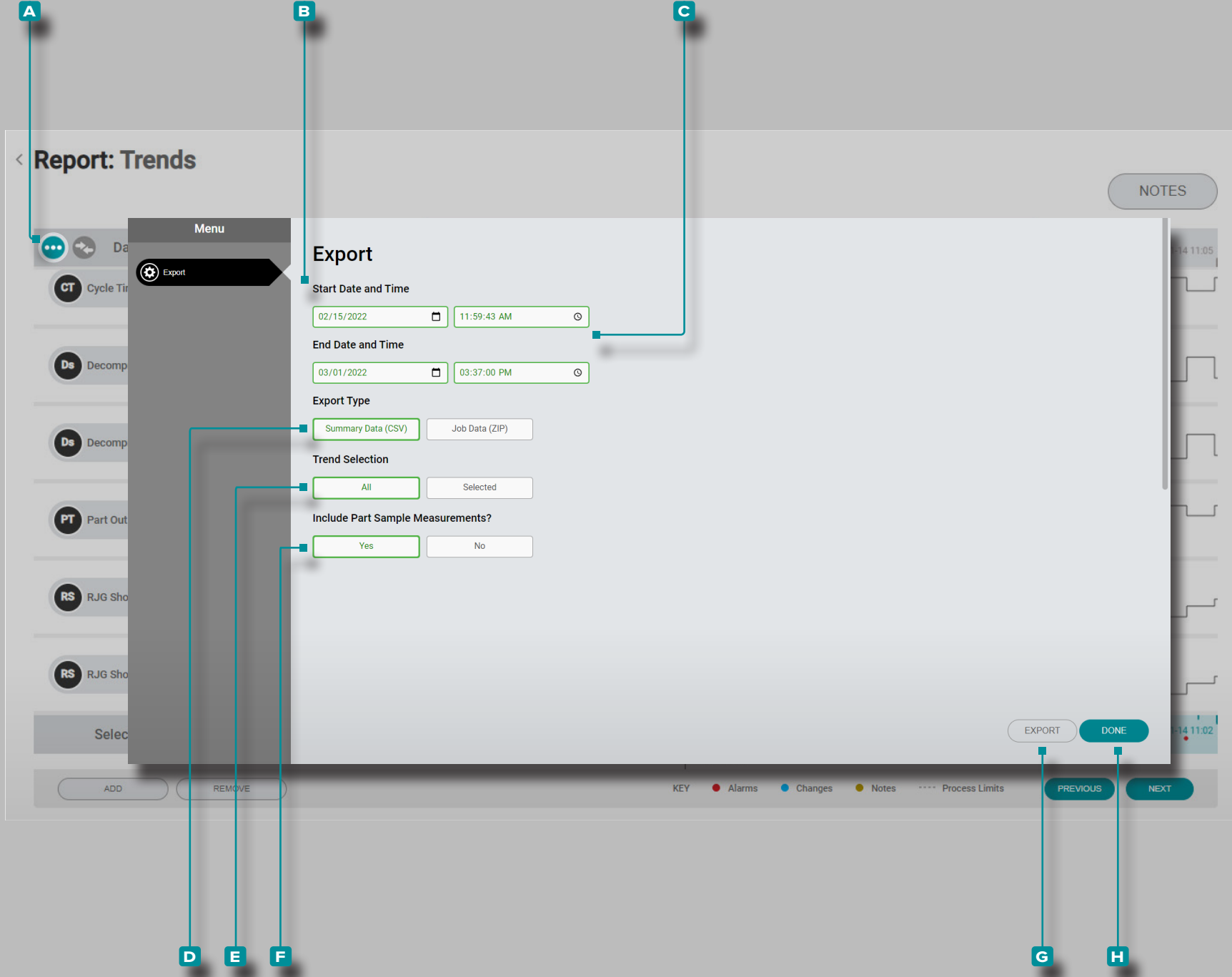
On the Cycle Graph, **tap**, **hold**, and drag the **A Quick Actions** menu slider to the left, then **click** the **B SHOW OVERLAYS** button.

Use the Summary Graph **C previous** button to overlay preceding cycles, the **D play** button to automatically overlay subsequent cycles, or **E next** button to overlay subsequent cycles on the Cycle Graph. The Cycle Graph will update automatically.

Clear Overlay Cycles

To remove overlay cycles, **tap** the **F HIDE OVERLAYS** button on the Cycle Graph **A Quick Actions** menu.

The Hub for Process Monitoring



Export Summary Graph Trends

Summary Graph trends can be exported to a comma-separated values (.csv) file which includes timestamp, date/time, trend value, and any notes entered for the selected trend(s).

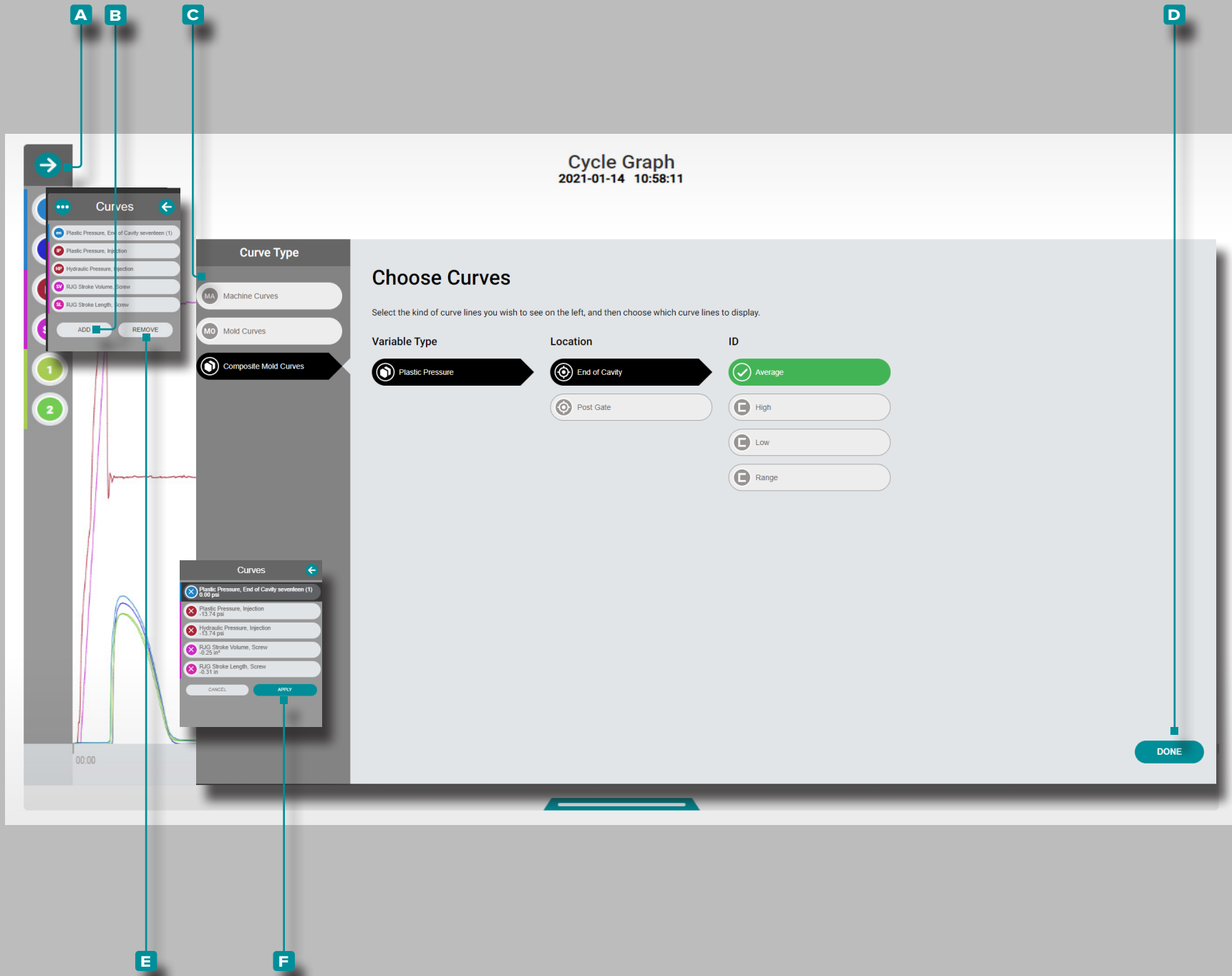
Click ^{*} on the **A** summary graph menu button; the summary graph trends export window will appear.

Select a **B** Start Date and Time and an **C** End Date and Time, then click ^{*} to select an export type—either **D** Summary Data (.csv) or Job Data (.zip), then click ^{*} to select which **E** trends to export—all available curves or only the currently selected curves, and then click ^{*} to select whether to include **F** part sample measurements.

Click ^{*} the **G** EXPORT button to generate a downloadable .csv file.

Click ^{*} the **H** DONE button when done to exit the window.

The Hub for Process Monitoring



Add or Remove Cycle Graph Curves

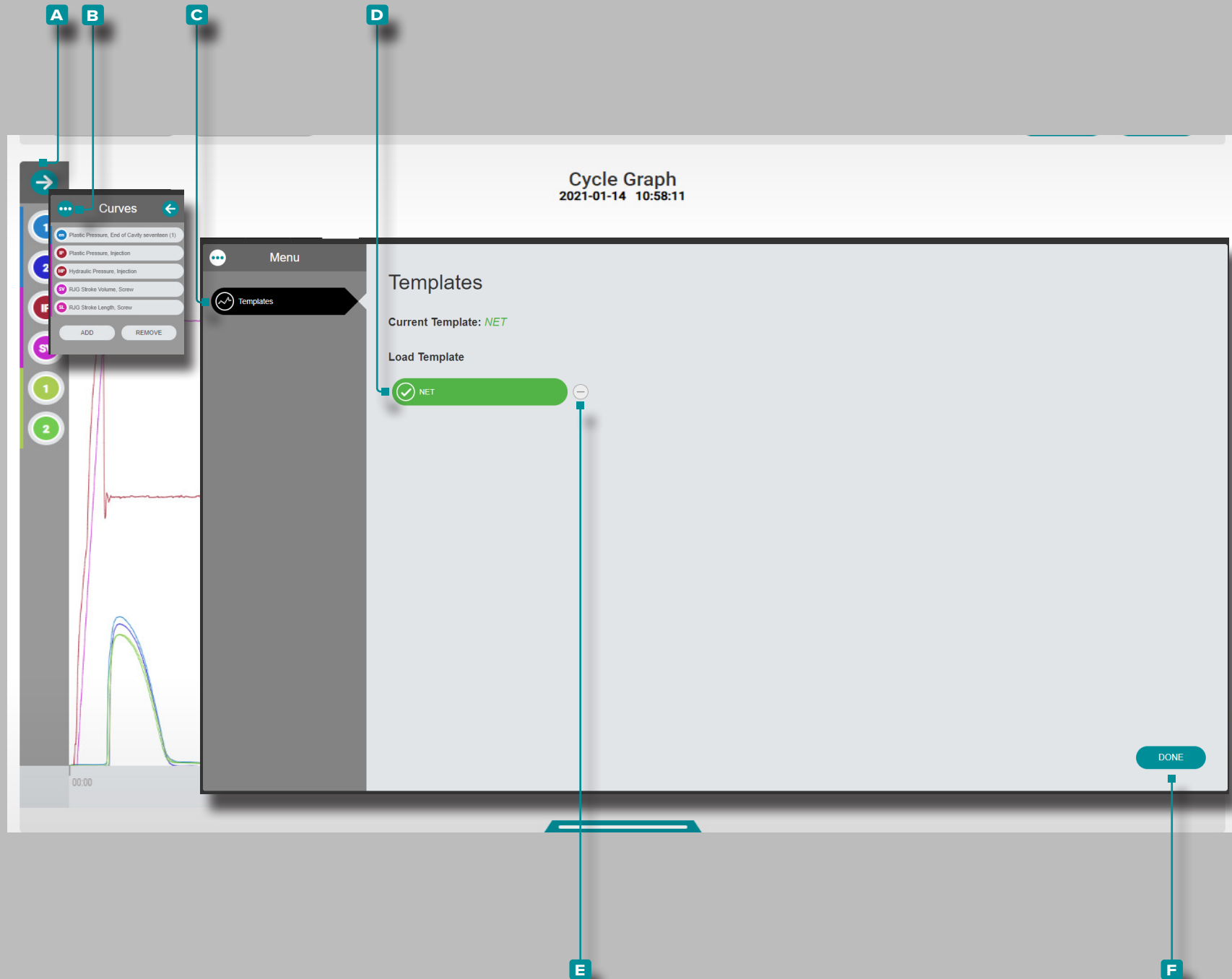
Add Cycle Graph Curves

To select and view additional cycle curves, **click** the **A expand** arrow to view the curve menu, **click** the **B Add** button, then **click** **C machine curves, mold curves, or composite mold curves**. **Click** the desired curve variable type from the list, and location and ID (if necessary) and then click **D DONE**; the selected curve(s) will be added to the cycle graph.

Remove Cycle Graph Curves

To remove cycle curves, **click** the **A expand** arrow to view the curve menu, **click** the **E remove** button, **click** to select a curve, and then **click** the **F apply** button to dismiss the selected curve.

The Hub for Process Monitoring



Add or Remove Cycle Graph Curve Template

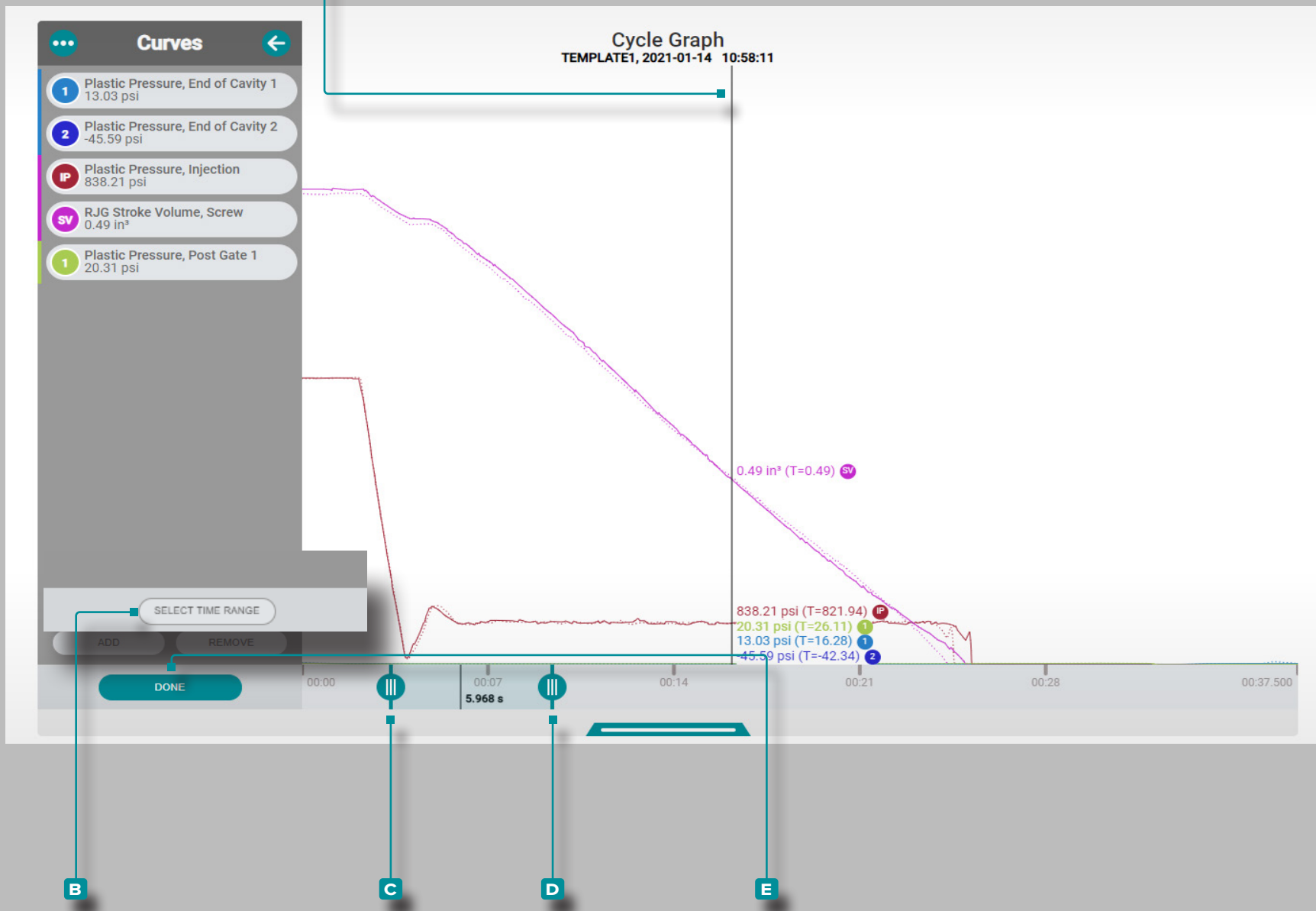
Add Cycle Graph Curve Template

To select and view a cycle curve template, **click** the **A** expand arrow to view the curve menu, **click** the **B** menu button, then **click** the **C** Templates button; **click** the desired **D** template. **Click** the **F** DONE button; the selected template curve(s) will be added to the cycle graph as dotted lines.

Remove Cycle Graph Curve Template




To remove a cycle curve template, **click** the **A** expand arrow to view the curve menu, **click** the **B** menu button, then **click** the **C** Templates button. **Click** the **E** remove button to deselect/remove a template from view on the cycle graph. **Click** the **F** DONE button.

The Hub for Process Monitoring










Cycle Graph Controls

Select a Data Point/Show Cursor

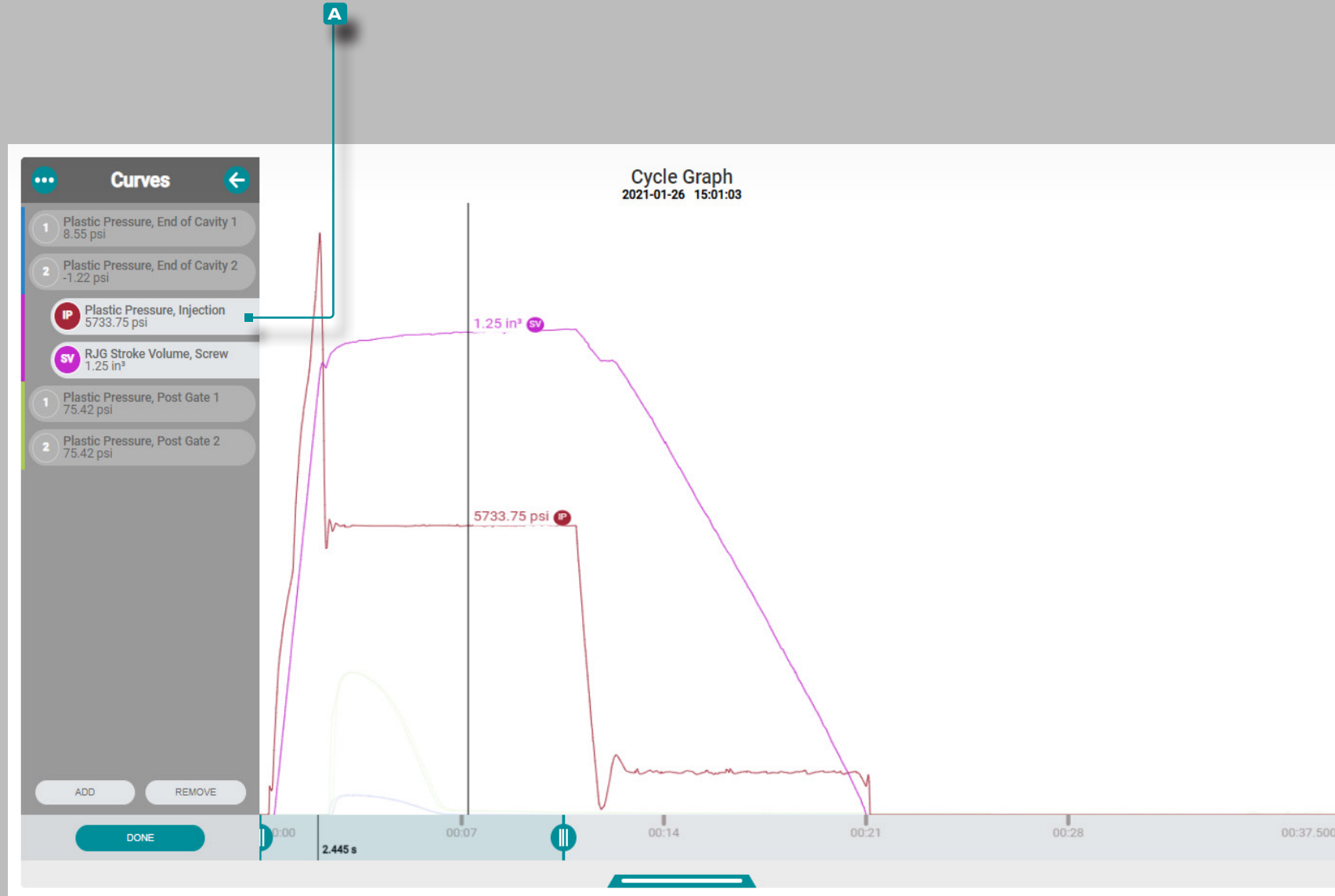
With a cycle selected on the Summary Graph, click  and hold on the cycle graph to view the  cursor and cycle data values (refer to "Summary Graph Trend Controls" "Select a Data Point/Show Cursor" on page 22). Click , hold, and drag on the cycle graph to drag the cursor left or right on the graph.

Zoom In or Out

Cycle curves are automatically scaled to show the entire job. Click  the  select time range button, then click , hold, and drag the  &  graph bars to zoom to or select a desired time period within the job.


Click , hold, and drag between the graph bars to move the zoom area to a different time period, and click  DONE to apply the changes.

The Hub for Process Monitoring





(Cycle Graph Controls, *continued*)

Pan Through Cycles, or Play Cycle-by-Cycle

Click  the NEXT button **on the Summary Graph** to play through the data until the job end, or the PREVIOUS button **on the Summary Graph** to play through the date until the job start (refer to "Summary Graph Trend Controls" "Add Summary Graph Trends" "Pan Through Cycles, or Play Cycle-by-Cycle" on page 22).

Highlight a Curve or Curves

Click  and **hold** on a **A** **curve label** to temporarily highlight that curve on the graph while other visible curves are faded until the curve label is released **OR**

Click , **hold**, and **drag** a **A** **curve label** **to the right** to highlight that curve on the graph while other visible curves are faded until the curve label is dragged back to the original, in-line position.

The Hub for Process Development

Dashboard

Parts

Part Samples

Molds

Processes

Setup Sheets

Machines

Materials

11:49am, 11/29/23

Choose a Workflow

LAUNCH A NEW MOLD

IMPORT A SIMULATION

IMPORT HUB DATA

TRANSFER A MOLD

START A CORRELATION STUDY

MIGRATE EDART DATA

Latest Part Samples

Group	Type	Part Numbers	Status	Cycle
QC Sample	QC	DPart1x	Pending Measurements	1
HuskyQC Sample1	QC	H_P002	Pending Measurements	2
HuskyQC Sample2	QC	H_P002	Cancelled	1 / 2
TensileQC Sample1	QC	TB-P001	Completed	1
HuskyGS2	Group	H_P001	Completed	6
HuskyGS1	Group	H_P001	Completed	6
HuskyGS3	Group	H_P001	Completed	6
TensileQC Sample2	QC	TB_P001	Completed	1

Latest Machine Setup Sheets


Name	Mold	Process	Created By
FCS65SV, 1.02 in	Charger	ChargerUP1	admin admin
--	APZ	APZ	admin admin
--	DEMOMOLD	DEMOPROCESS	admin admin
--	CURT-MOLD-1	CURT PROCESS 2	admin admin
CURT-MACHINE-1, 1.00 in	CURT-MOLD-1	CURT PROCESS 2	admin admin
TEST, 1.75 in	TEST	TEST	Logan Teut
ENGEL E-MOTION 55, 30.00 mm	PCB 1 1	PMA TRIAL	Admin Admir
MLD428-12.00 mm	CURT-MOLD-1	CURT-PROCESS 1	admin admin
DEMAG 2 SCREW 35MM, 35.00 mm	FACE PLATE	PMA TRIAL 1	Admin Admir

This software is not currently licensed for Mold Transfer.

This software is not currently licensed for Simulation Import.

Application Overview

The Hub for Process Development provides a user-entered database of part, part sample, mold, process, setup sheet, machine, and material records, and allows users to import job data or perform correlation studies. The Hub for Process Development dashboard additionally provides access to The Hub for Mold Transfer and The Hub for Simulation Support tools; these tools will only function if the correct licenses are applied to the software.

Click  on the corresponding menu button to view The Hub for Process Development dashboard to import job data, view or add records for part, part sample, mold, process, setup sheet, machine, and material records, start a correlation study, launch a new mold or transfer a mold, and import a simulation.

The Hub for Process Development

Dashboard

Parts

Part Samples

Molds

Processes

Setup Sheets

Machines

Materials

Mold Details

Part Details

Parts

Processes

Revision History

+

Hello, admin admin
10:37am, 10/03/22

< Mold:

MOLD DETAILS

Name*

Cavities

Die Width*

Serial Number*

Die Height*

Minimum Mold Open*

Created By

Die Length*

CAVITY NAMES

KNOCKOUT PATTERN

Knockout Standard*

#	Horizontal	Vertical	Diameter	Mirror
1	Center	Center	<div></div> <div></div>	<div></div>

PART DETAILS

Part

Part Surface Area*

Total Part Volume*

Runner Volume*

CANCEL

ARCHIVED

SAVE

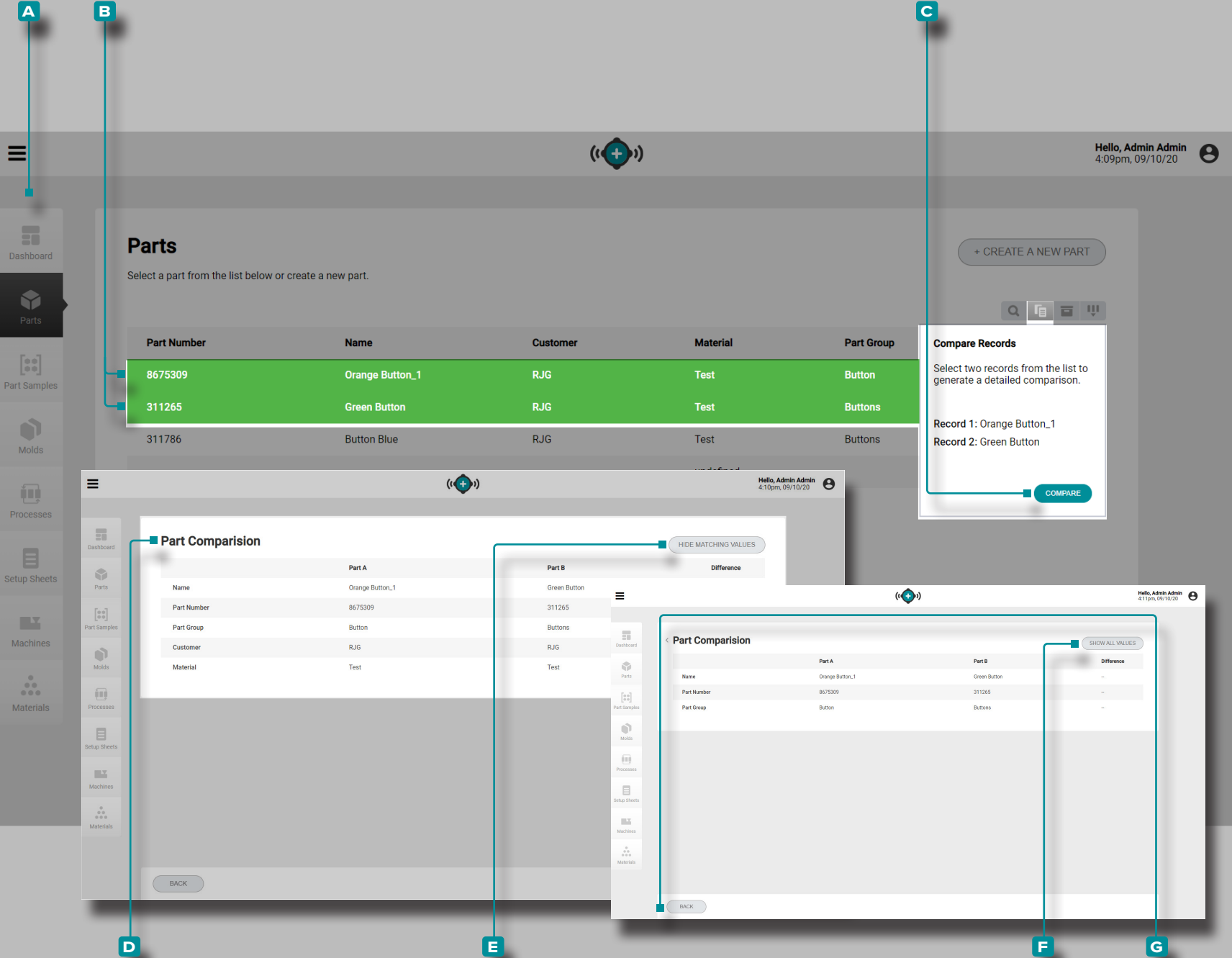
Creating Records

A record can be created without entering the items that are required for use with the process transfer “Launch a New Mold” or “Transfer a Mold” tools in order for the machine/ mold fitment to be determined; refer to each record section in this guide for items that are required to satisfy mold transfer requirements for these tools.

Fields required for record creation **A** are outlined in red.
Fields required for mold transfer **B** are outlined in yellow.

31

The Hub for Process Development

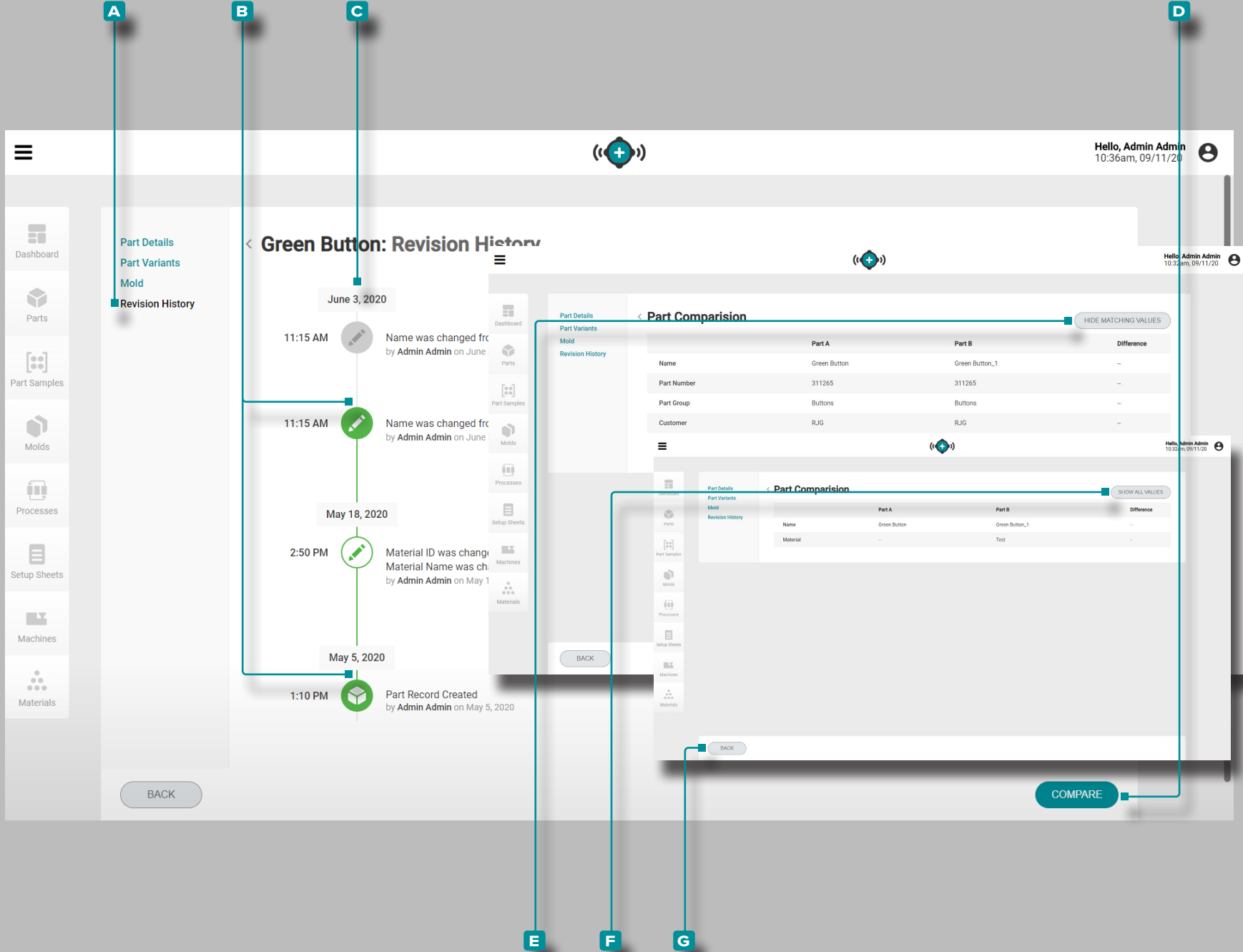


Comparing Records

Each records page (parts, molds, processes, setup sheets, machines, and materials) provides a list of records with the ability to compare two records. A comparison of two records shows a side-by-side comparison of each record's information, with the option of hiding matching values to quickly identify differences between the records.

Navigate to a records page (parts, molds, processes, setup sheets, machines, or materials); **click** the **A compare** button, then **click** on **B two records** to select which two to compare, then **click** the **C COMPARE** button. The **D compare records** page will display both records' information beside one another; to hide all matching information/values the records share, **click** the **E HIDE MATCHING VALUES** button. To view all information after hiding matching values, **click** the **F SHOW ALL VALUES** button. When done comparing records, **click** the **G BACK** button to return to the records page.

The Hub for Process Development



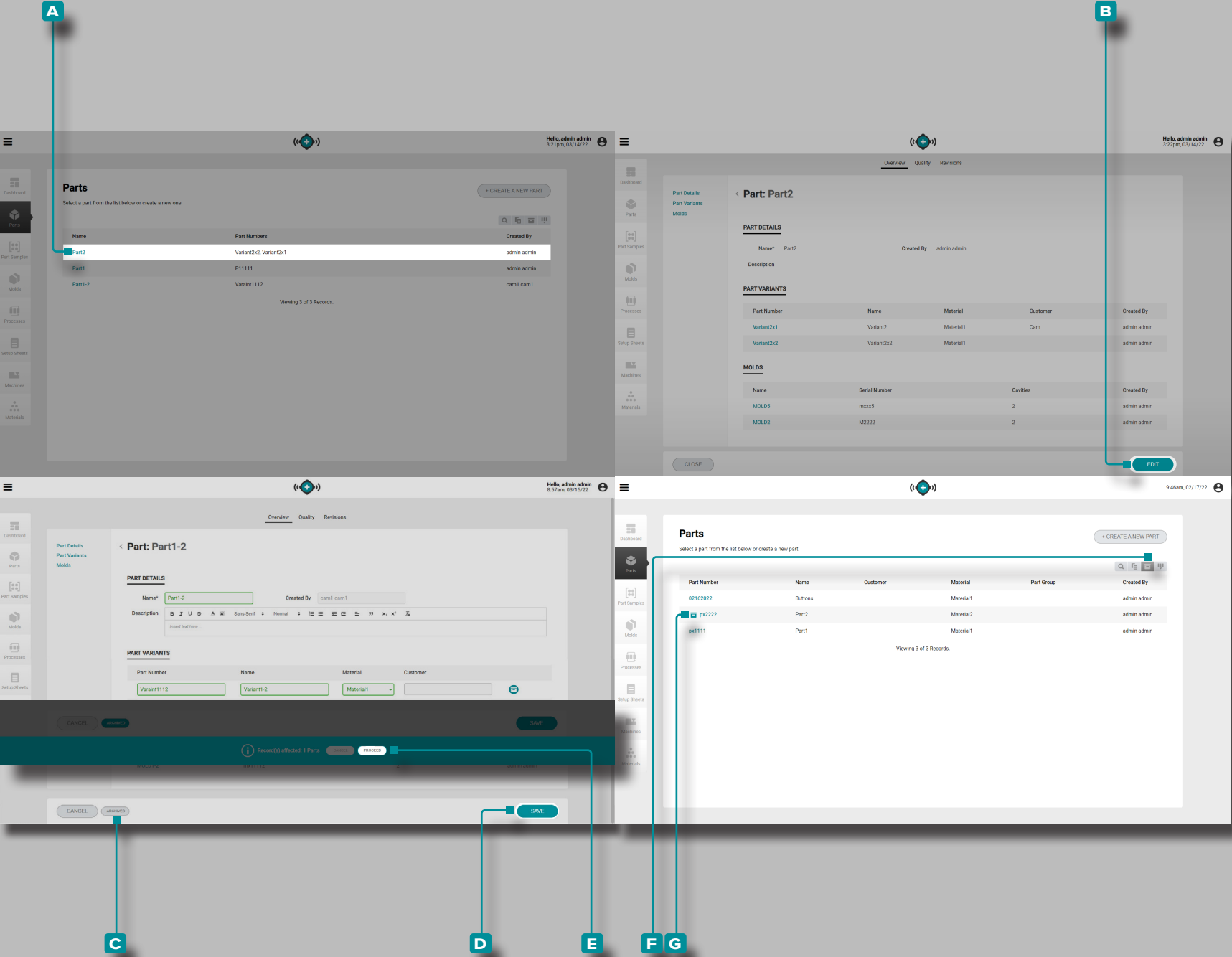
Comparing Record Revision History

Each record type provides a record revision history within the record. The revision history displays when the record was created, and each change made to the record since creation. Revision versions of each record can be compared easily using the compare records function.

While viewing a record, **click** **A** **Revision History** to view the revision history for that record (for part records, select the "Revisions" tab, then select Revisions History; refer to "Revision History" on page 40) . **Click** any two **B** icons next to a date and time along the **C** **revision history timeline** to select for comparison the two selected dates/times; **click** the **D** **COMPARE** button to view the side-by-side comparison.

The comparison page will display both date/time revision history records' information beside one another; to hide all matching information/values the records share, **click** the **E** **HIDE MATCHING VALUES** button. To view all information after hiding matching values, **click** the **F** **SHOW ALL VALUES** button. When done comparing records, **click** the **G** **BACK** button to return to the record's revision history page.

The Hub for Process Development



Archiving Records

Parts, molds, processes, setup sheets, machines, and materials records can be archived so that the record will be unavailable to use on connected CoPilot systems.

Navigate to a records page (parts, molds, processes, setup sheets, machines, or materials); **click** a **A** record name/number to select it and view the record details; then **click** the **B** edit button, and then **click** the **C** ARCHIVED button to archive or un-archive the record. **Click** the **D** SAVE button to complete the archival.

A user notification will appear in order to confirm the archive of the selected record; if other records are affected by the archival, the affected record information will be included in the notification. **Click** the **E** PROCEED button to confirm record archival.

By default, archived records will be hidden from the listed records. To view archived records, **click** the **F** view archived records button to view all records, including archived records. Archived records will have an **G** archived records icon next to the record name/number in the record list.

The Hub for Process Development

Sorting and Searching Records

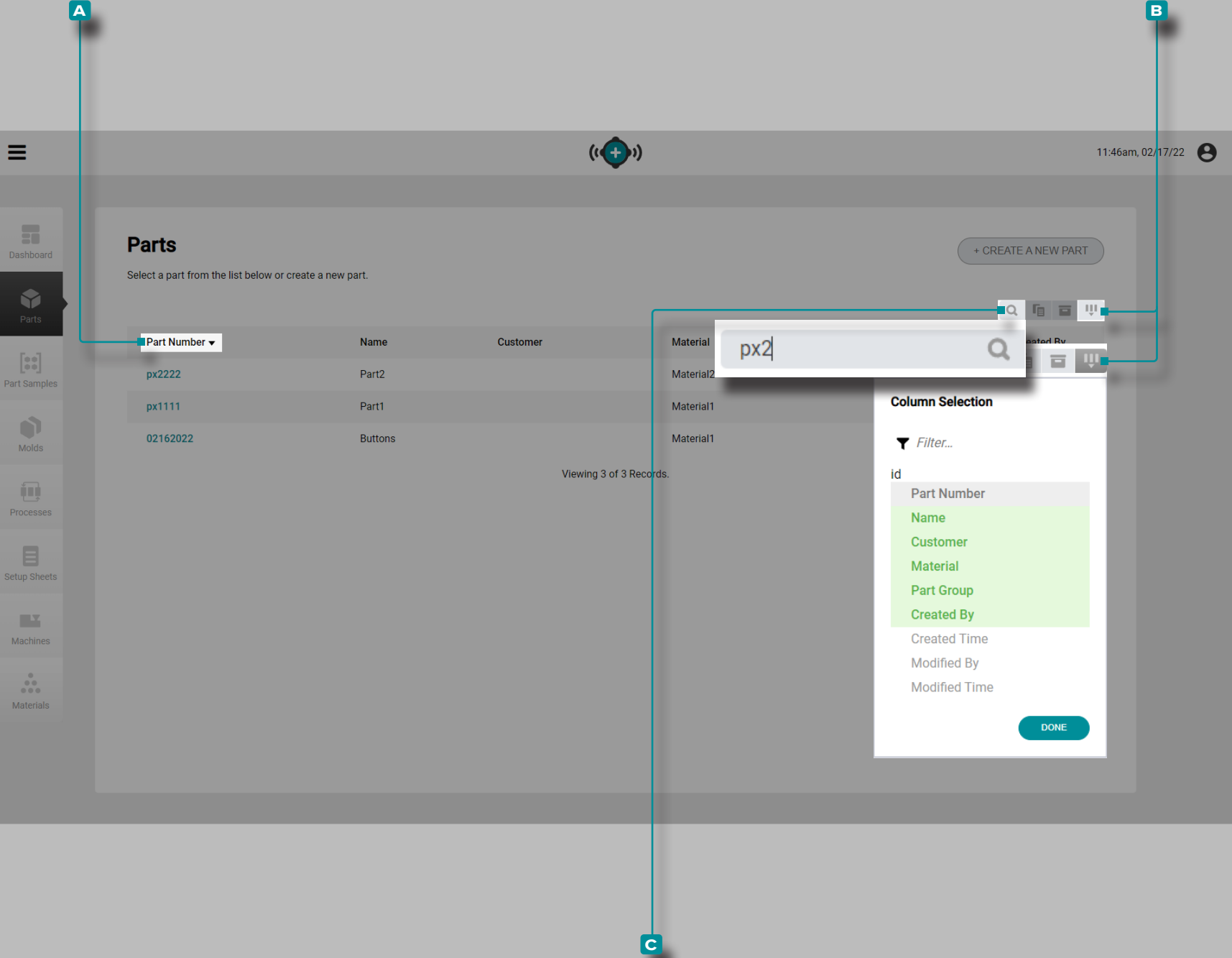
Sorting Records

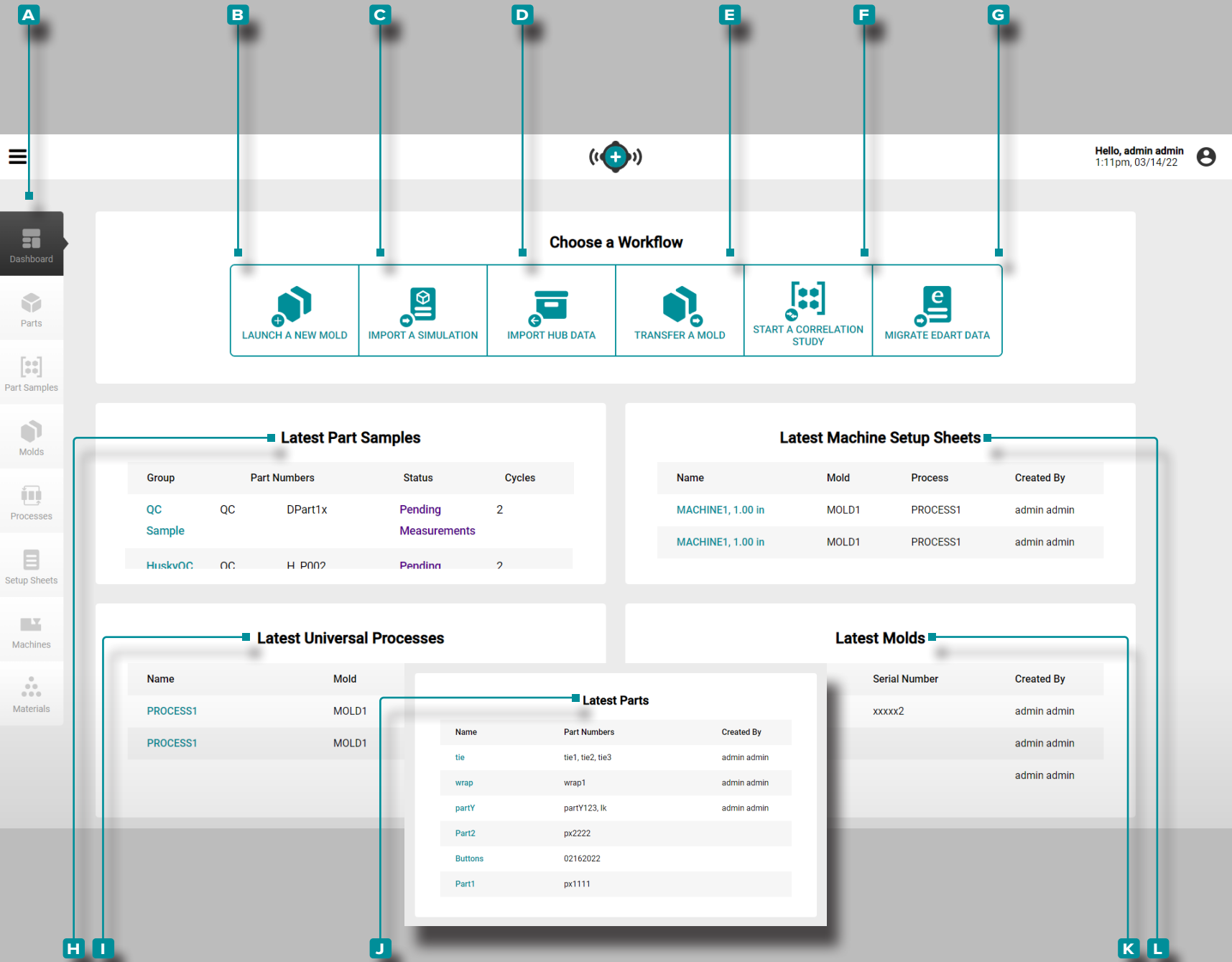
Each records page (parts, molds, processes, setup sheets, machines, and materials) can be sorted using the column headings. **Click** a **A column heading** to sort the records in ascending order; **click** the column heading a second time to sort the records in descending order. A triangle is displayed next to the column that is sorted. If the triangle point is facing up, the column is being sorted in ascending order; if the triangle point is facing down, the column in being sorted in descending order.

Select which columns and corresponding record information are visible; **click** the **B column selection** button, then **click** to select/deselect columns to display on the records page. Selected column headings are highlighted in green.

Searching Records

Each records page (parts, molds, processes, setup sheets, machines, and materials) can be searched using alphanumeric text. **Click** the **C search icon**, then **enter** the text by which to search. Any matching records will be displayed, while any un-matching records will be hidden until the search is cleared and exited.





The Hub for Process Development

Dashboard

The **A Dashboard** provides a quick view of the top ten latest machine setup sheets, universal processes, molds, and parts, along with access to the launch a new mold, import a simulation, import job data, transfer a mold, and start a correlation study functions.

Launch a New Mold

If licensed, use the **B Launch a New Mold** tool to launch a new mold by entering part and mold records, selecting (or entering) a compatible machine, and generating a setup sheet and a process (refer to "Launch a New Mold" on page 82).

Import a Simulation

If licensed, use the **C Import a Simulation** tool to import a mold simulation file (refer to "Import a Simulation" on page 86).

Import Job Data

Use the **D Import Job Data** tool to import job data from another The Hub software instance (refer to "Import Hub Data" on page 67).

Transfer a Mold

If licensed, use the **E Transfer a Mold** tool to transfer an existing mold from one machine to another by selecting part, mold, and process records, selecting a compatible machine, and generating a setup sheet (refer to "Transfer a Mold" on page 84).

Start a Correlation Study

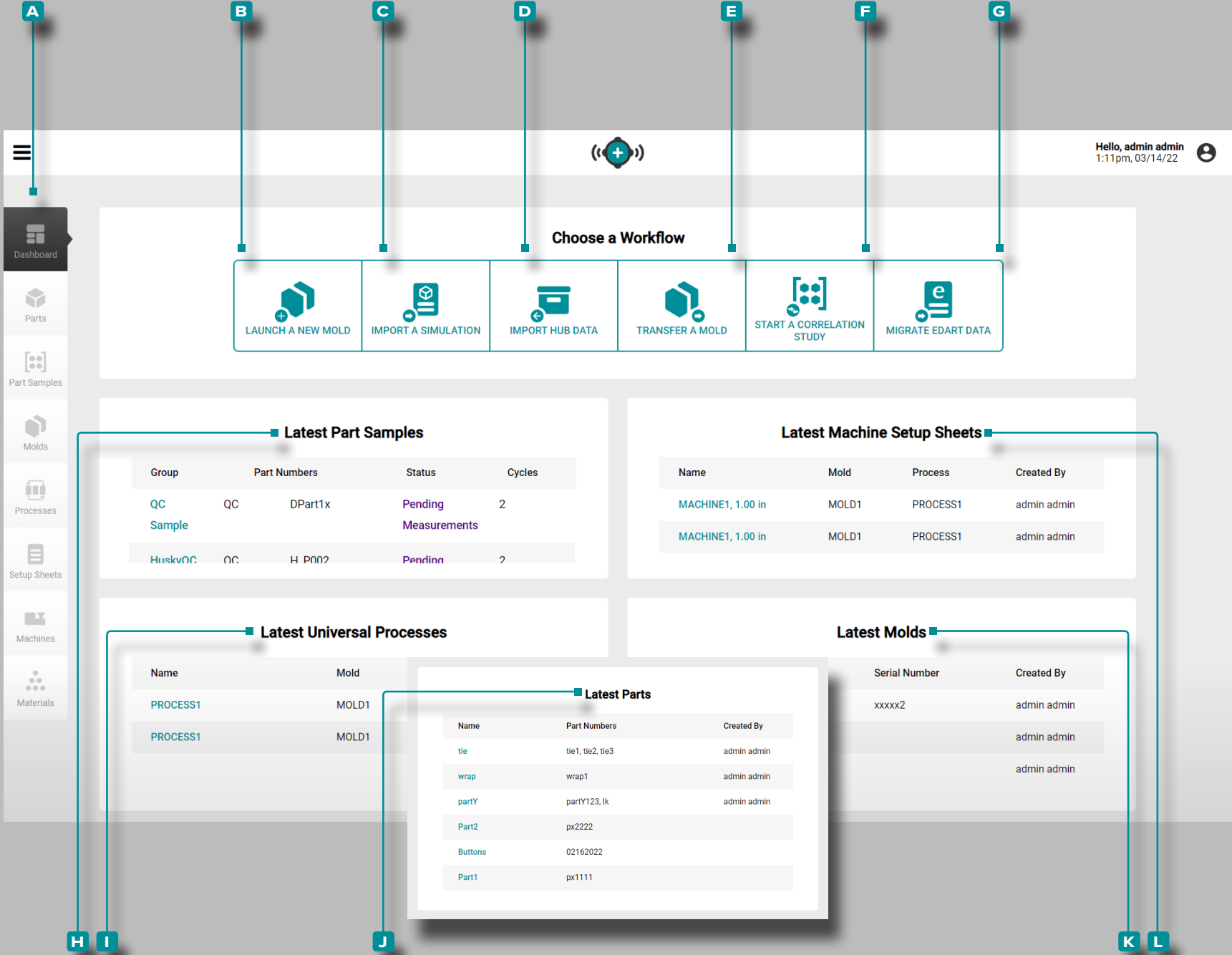
Use the **F Start a Correlation Study** tool to find correlations between parts and process data by selecting part samples with completed critical-to-quality (CTQ) measurements with the same mold from different processes (refer to "Start a Correlation Study" on page 68).

Migrate eDART Data

Use the **G Migrate eDART Data** tool to import eDART configurations into The Hub software for use with CoPilot systems (refer to "Start a Correlation Study" on page 68).

(continued on next page)

The Hub for Process Development



(continued from previous page)

Latest Part Samples

The **H Latest Part Samples** displays the 10 most recent part samples with group, part numbers, status, and number of cycles.

Latest Universal Processes

The **I Latest Universal Processes** displays the 10 most recent universal processes with name, mold, cycle time, and created by username.

Latest Parts

The **J Latest Parts** displays the 10 most recent parts by name, customer, and created by username.

Latest Machine Setup Sheets

The **K Latest Machine Setup Sheets** displays the 10 most recent machine setup sheets with name, mold, process, and the created by username.

Latest Molds

The **L Latest Molds** displays the 10 most recent molds with name, cavities, and created by username.

The Hub for Process Development

Parts

Part Records

Part records A are entered and shown on the Parts page. **Click** on a part number to view part overview, quality, and revision history information. **Part records A** can also be compared to one another using the compare records feature; refer to "Comparing Records" on page 32 for information on comparing records.

Overview

The **A Part records B Overview** tab provides the part details, part variants, and associated molds.

Part Details

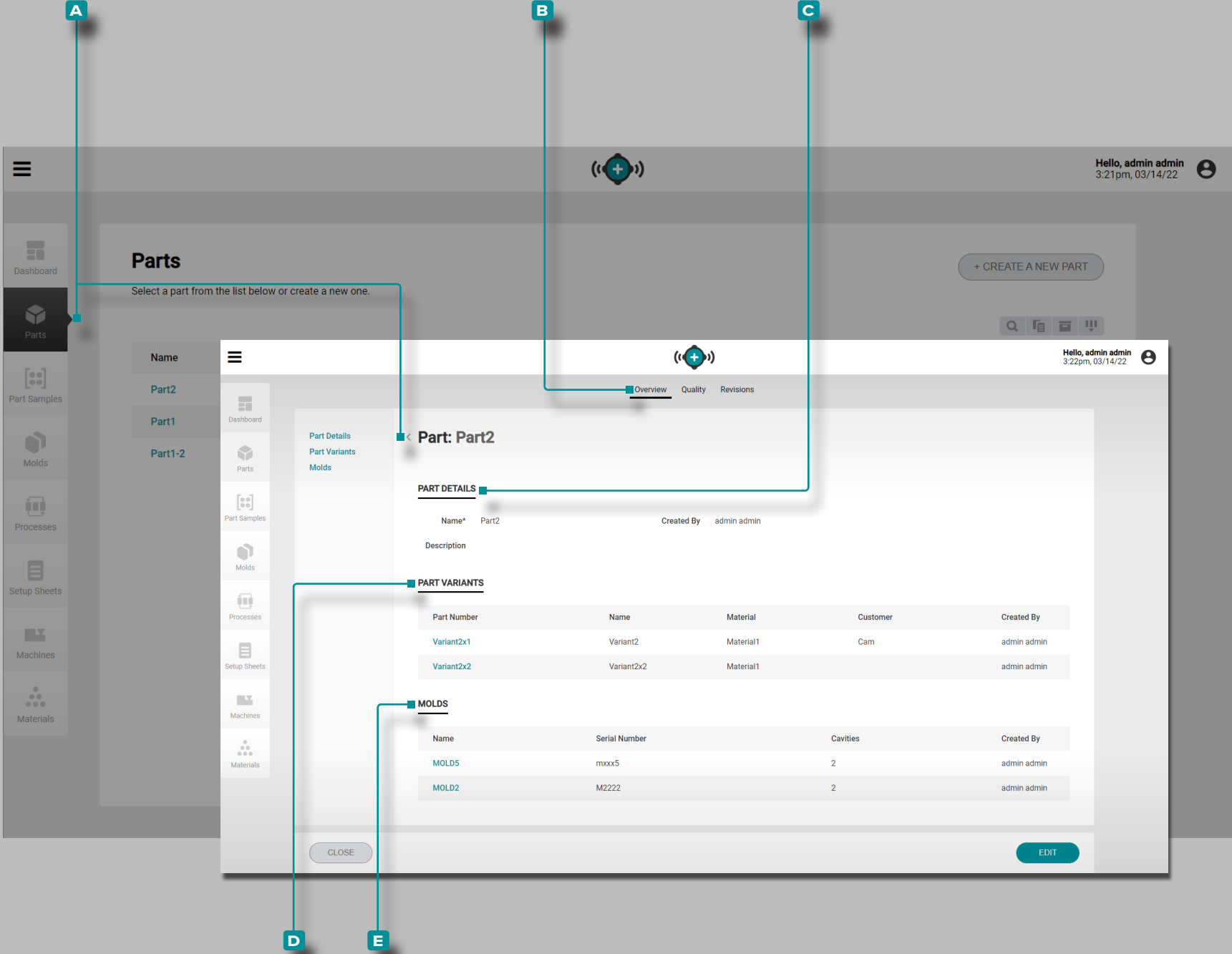
Part Details C contains the part name, who the part was created by, and a description (if entered).

Part Variants

Part Variants D includes the part number, name, material, customer, and who the part was created by of any part variants. Part variants are created to associate parts made from the same mold but with different materials/customers/processes, and to associate part measurements with any samples taken of the part variant.

Molds

The **E Molds** section displays the associated mold(s) for the part; for more information on mold record associations, refer to "Molds" on page 46.



The Hub for Process Development

(Part Records, *continued*)

Quality

The **A** Part records **B** Quality tab provides any critical-to-quality (CTQ) characteristics, group samples, and quality control (QC) samples for the selected part.

CTQ Characteristics

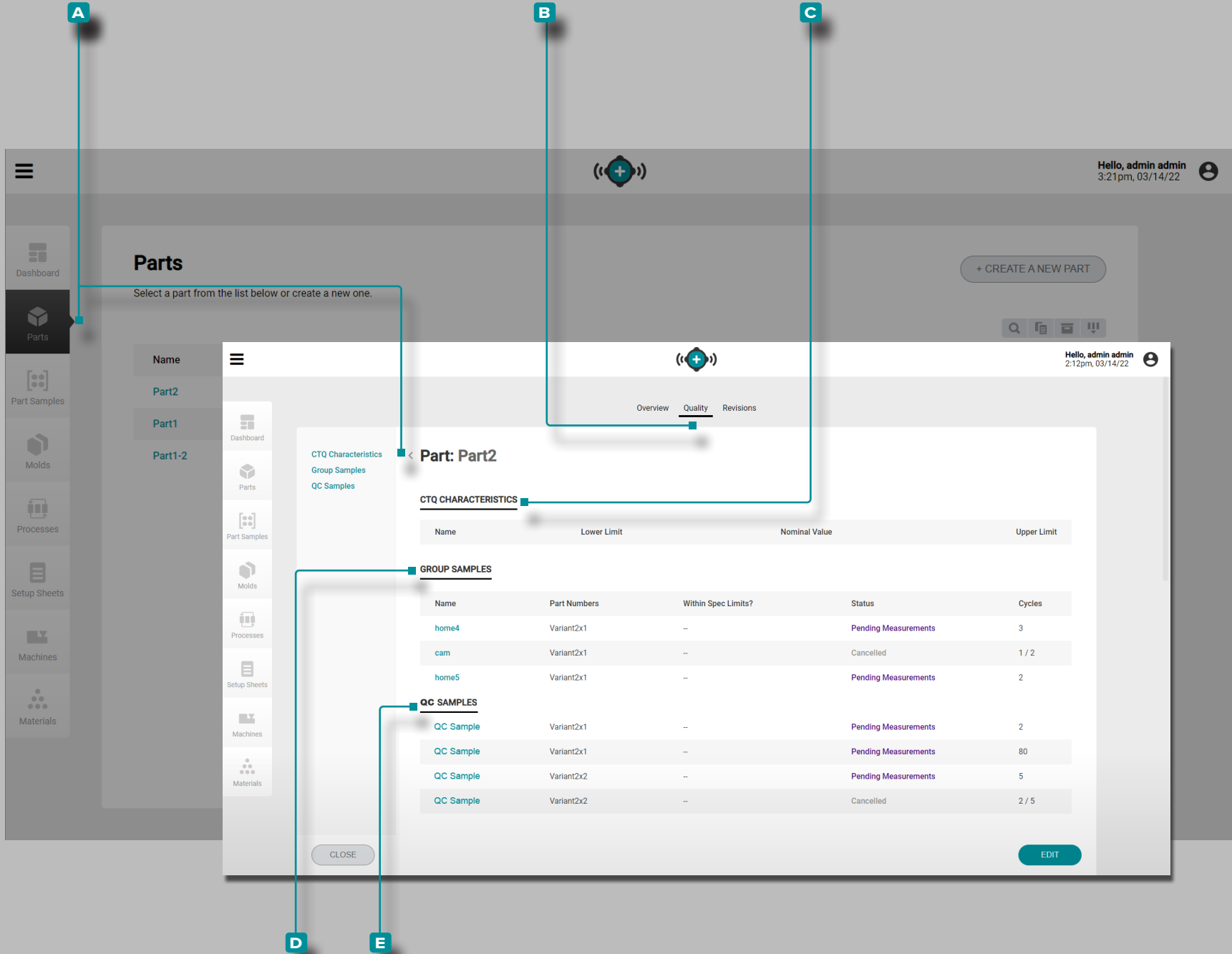
CTQ Characteristics **C** contains the CTQ name, lower limit, nominal value, and upper limit. The entered CTQ values will be used when part measurements are entered for part samples (refer to "Edit a Part Record: CTQ Characteristics" on page 43 and "Enter Part Measurements" on page 45).

Group Samples

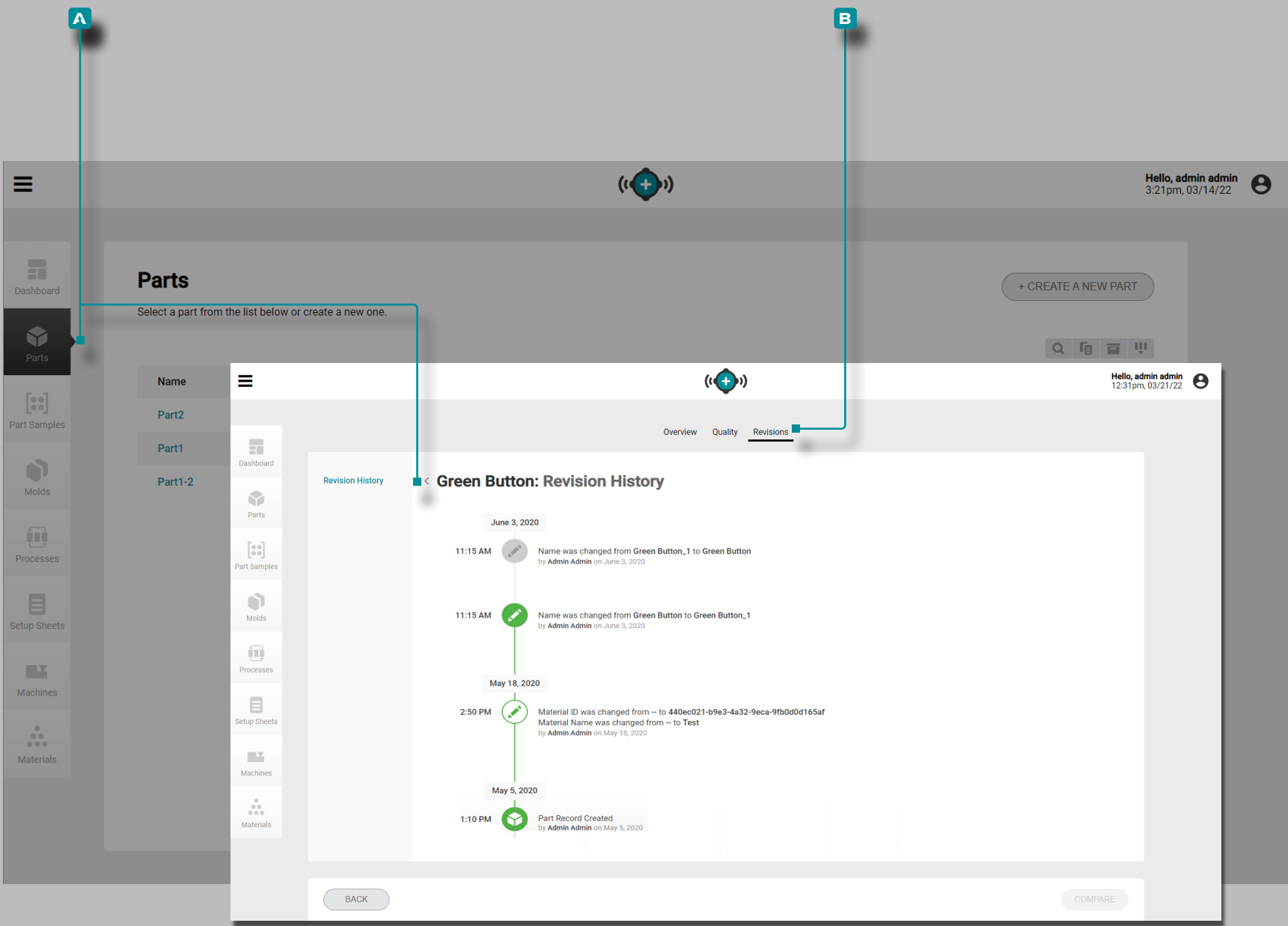
Group Samples **D** for the selected part are displayed in list form. **Group Samples** **D** includes the group sample name, associated part number (variant), if the sample is within specified limits (yes/no), status (completed/canceled/pending measurements), and (number of) cycles.

QC Samples

QC Samples **E** for the selected part are displayed in list form. **QC Samples** **E** includes the sample name, associated part number (variant), if the sample is within specified limits (yes/no), status (completed/canceled/pending measurements), and (number of) cycles.




The Hub for Process Development



(Part Records, *continued*)

Revisions

Revision History

The **A** Part records **B** Revision History tab is a log of user-initiated actions that occur within the software, providing a record of each user action related to the record while logged in. Click  on the **B** Revision History heading to view the part record revision history. Refer to "Comparing Record Revision History" on page 33 for information on comparing record revisions.

NOTE *Revision History is visible only to the users designated with administrator and process engineer roles.*

The Hub for Process Development

The screenshot shows the 'Parts' hub interface. At the top, a header bar contains a menu icon, a user profile icon, and the text 'Hello, admin admin 3:21pm, 03/14/22'. Below the header, the 'Parts' section is titled 'Parts' with a '+ CREATE A NEW PART' button. A list of parts is shown: 'Part2', 'Part1', and 'Part1-2'. A modal window is open for creating a new part. The modal has a sidebar with 'Part Details', 'Part Variants', and 'Molds'. The 'Part Details' section is active, showing a 'Name*' field, a 'Created By' field, and a 'Description' field with a rich text editor. The 'Part Variants' section is also visible, showing a table with columns 'Part Number', 'Name', 'Material', and 'Customer'. The 'Molds' section is blank. At the bottom of the modal, there are 'CANCEL', 'ARCHIVED', and 'SAVE' buttons. Callout letters A through F point to specific elements: A points to the '+ CREATE A NEW PART' button; B points to the 'Name*' field; C points to the 'Description' field; D points to the 'Part Variants' section; E points to the 'CANCEL' button; and F points to the 'SAVE' button.

A + CREATE A NEW PART

B Name*

C Description

D Part Variants

E CANCEL

F SAVE

Create a New Part Record

Click the **A** CREATE A NEW PART button on the parts records page.

Enter the **B** Part Details Name (this is a required field); the Created By field will automatically populate with the current user's name).

Optionally, enter a part **C** description.

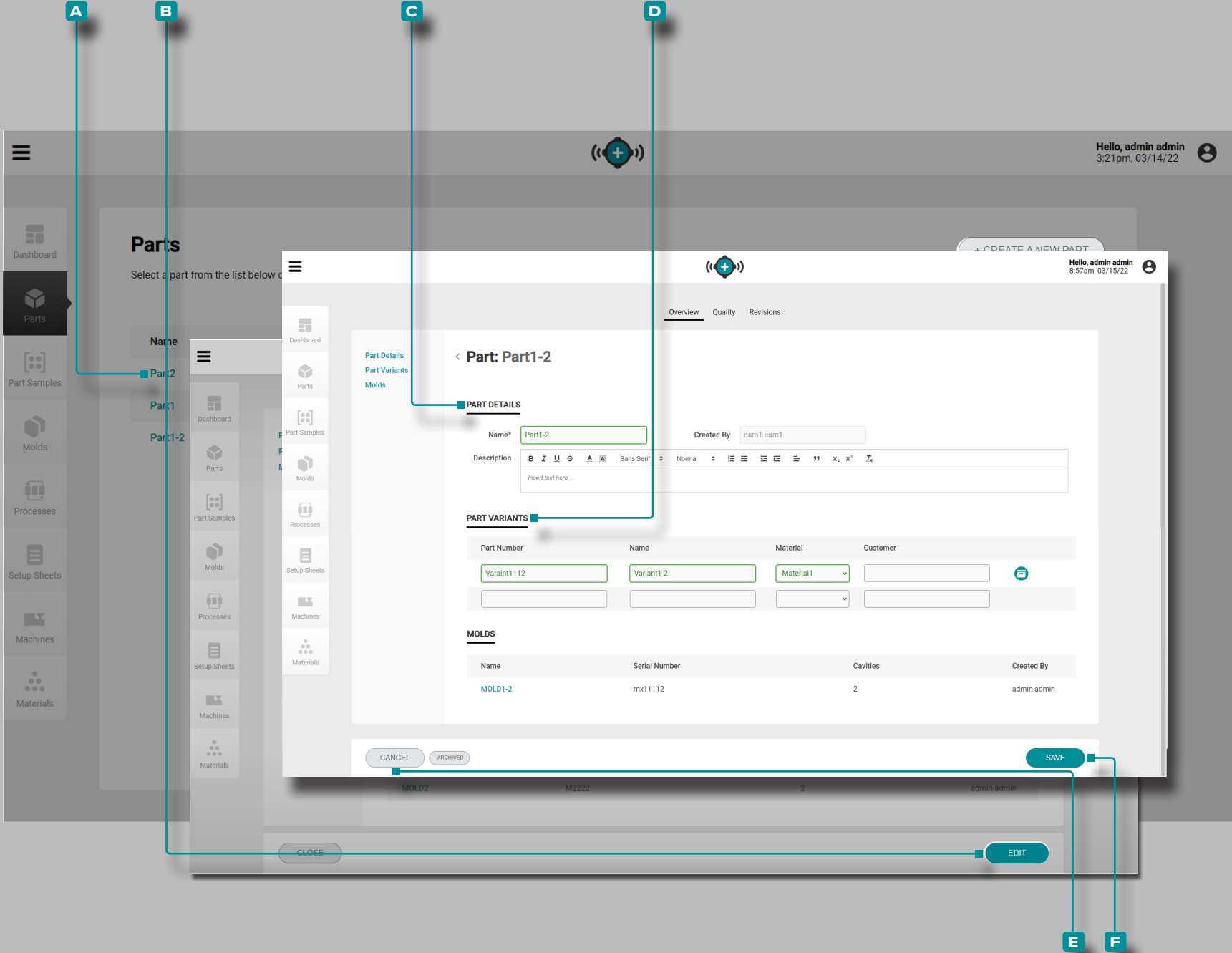
Optionally, enter the **D** Part Variants for the part (part variants can be created from the part record at any time as long as the part record has not been archived); refer to "Part Variants" on page 38.

Information for **D** Part Variants include Part Number, Name, Material, and Customer, and are optional. However, if a part variant is entered, then the Part Number, Name, and Material are required—the Customer field is optional.

The Molds section will be blank; parts and mold can be associated when a new mold is launched or when a mold is transferred (when a setup sheet and process is created).

Click the **F** SAVE button to save the part record, or the **E** CANCEL button to exit without saving the record.

The Hub for Process Development



Edit a Part Record Overview

Click the **A** part number on the Parts records page to view the part record. Click the **B** EDIT button to edit the overview part details.

Edit the **C** part details (Name, Number, Group, Material, or Customer; the Created By field will automatically populate with the current user's name).

Edit or add a **D** part variant (Part Number, Name, Material, or Customer).

Mold associations cannot be edited.

Click the **F** SAVE button to save the part record, or the **E** CANCEL button to exit without saving the record.

The Hub for Process Development

The screenshot shows the 'Parts' application interface. A sidebar on the left contains navigation icons for Dashboard, Parts, Part Samples, Molds, Processes, Setup Sheets, Machines, and Materials. The main area displays a 'Part: Part1' record. At the top of the record, there is a header bar with 'TestGroup2', 'P11111', and 'Pending Measurements'. Below this, there are tabs for 'Overview', 'Quality', and 'Revisions'. The 'Quality' tab is active, showing 'CTQ CHARACTERISTICS'. This section contains a table with columns: Name, Quantity, Lower Limit, Nominal Value, Upper Limit, and Unit. Below this is a 'GROUP SAMPLES' section with a table containing columns: Name, Part Numbers, Within Spec Limits?, Status, and Cycles. Callout boxes are placed as follows: A points to the 'Part1' link in the sidebar; B points to the 'Quality' tab; C points to the 'EDIT' button in the top header bar; D points to the 'CTQ CHARACTERISTICS' section header; E points to the 'SAVE' button at the bottom right; and F points to the 'CANCEL' button at the bottom left.

Callout A: Part number link in the sidebar.

Callout B: Quality tab at the top of the part record view.

Callout C: EDIT button to edit the CTQ Characteristics.

Callout D: CTQ Characteristics (Name, Lower Limit, Nominal Value, or Upper Limit).

Callout E: SAVE button to save the part record.

Callout F: CANCEL button to exit without saving the record.

Edit a Part Record: CTQ Characteristics

Click the **A** part number on the Parts records page to view the part record. Click the **B** Quality tab at the top of the part record view the CTQ Characteristics.

Click the **C** EDIT button to edit the **D** CTQ Characteristics.

Edit the **D** CTQ Characteristics (Name, Lower Limit, Nominal Value, or Upper Limit).

Group Samples and QC Samples cannot be edited from this page; refer to "Part Samples" on page 44

Click the **E** SAVE button to save the part record, or the **F** CANCEL button to exit without saving the record.

The Hub for Process Development

Part Samples

Part Sample Records

Part sample records **A** that were collected from CoPilot systems are shown on the Part Samples page. **Click** ^{*} on a part sample name to view details, associated job details, and measurements. Once a part sample is complete, measurements can be added to the record. Refer to X.

Part Sample Details

Part Sample Details **B** contains the information entered when a part sample record was created, including name, sample type, status, if the part sample is within the specified limits, cycle count, notes, and created by.

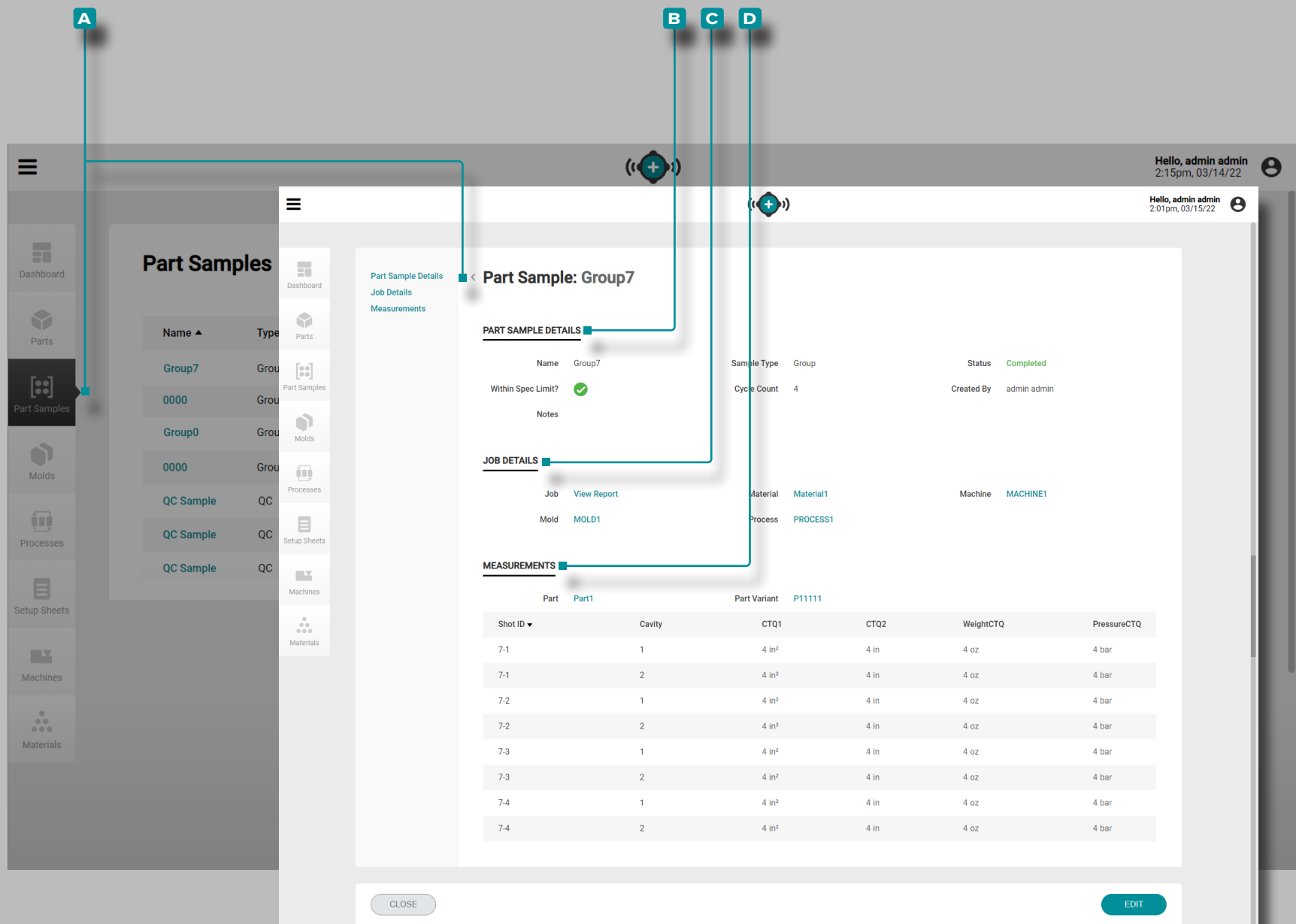
Part samples are designated either as a group sample or a QC sample when they are created. Group Samples are typically used during process development with a new mold. QC Samples are typically taken after process development, when a part is in production.

Job Details

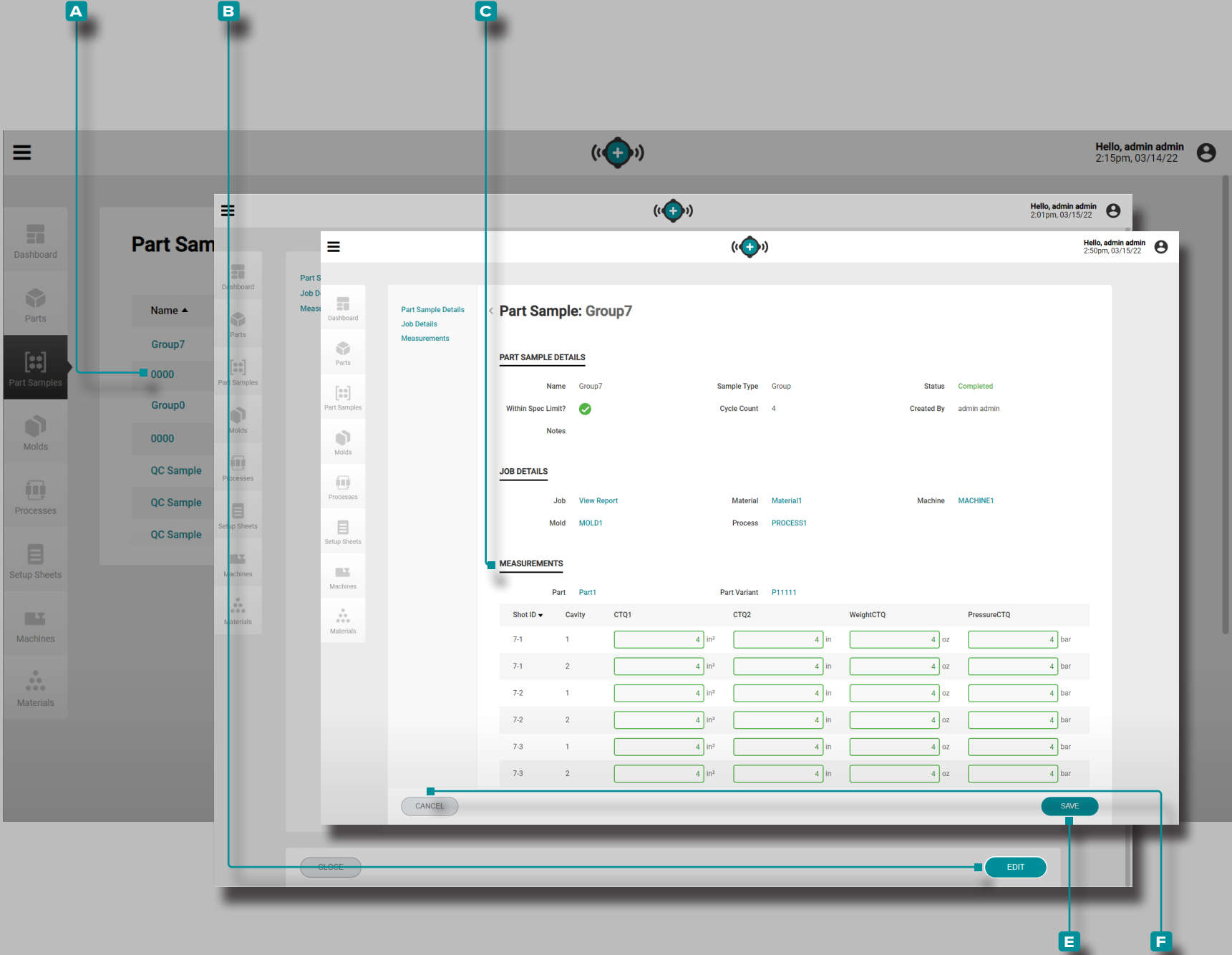
The **C Job Details** section will display the associated Job, Material, Machine, Mold, and Process for the sample. **Click** ^{*} on a Job, Material, Machine, Mold, or Process name to view the associated record.

Measurements

The **D Measurements** section will display the associated Shot ID, Cavity, and any entered CTQ characteristics assigned to the part and part variant for the sample. Refer to "Create a New Part Record" on page 41 for information on creating parts and "Edit a Part Record: CTQ Characteristics" on page 43 for information on entering CTQ characteristics.



The Hub for Process Development



Enter Part Measurements

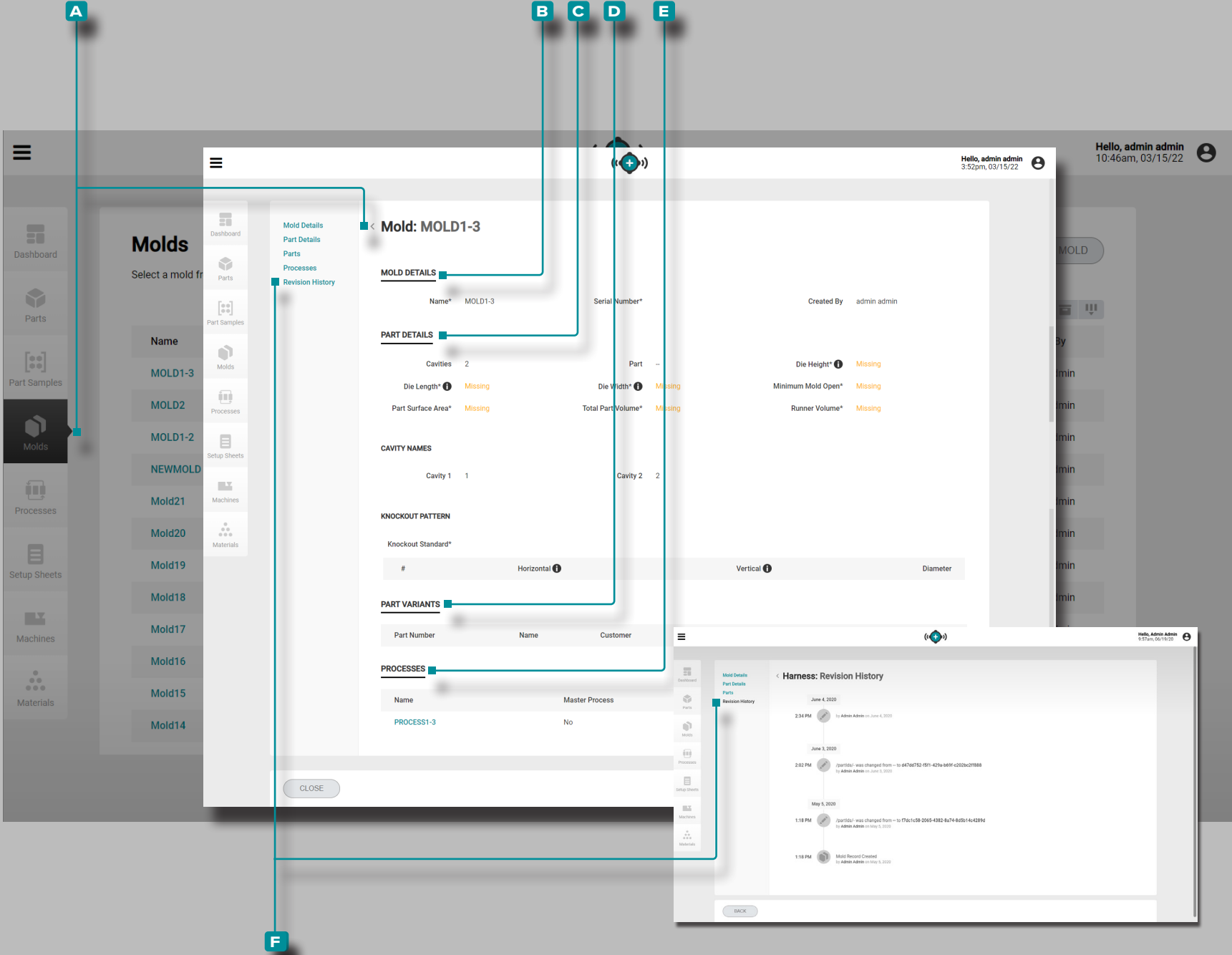
Click the **A** part sample name on the Part Samples records page to view the part sample record.

Click the **B** EDIT button to add **C** Measurements.

Enter the part **C** Measurements.


Click the **E** SAVE button to save the part record, or the **F** CANCEL button to exit without saving the record.

The Hub for Process Development



Molds

Mold Records

Mold records **A** are shown on the Molds page. Click  on a mold name to view mold details, associated part details, associated part variants, associated processes, and revision history. Mold records **A** can also be compared to one another using the compare records feature; refer to "Comparing Records" on page 32 for information on comparing records.

Mold Details

Mold Details **B** contains the information entered when a mold record was created, including mold name, serial number, and created by.

Part Details

Part Details **C** contains the physical part information entered when a mold record was created, including number of cavities, knockout standard, die height, die length, die width, minimum mold open, part surface area, part volume, and runner volume. If included, part details also displays cavity names and knockout pattern information.

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The Hub for Process Development

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Part Variants

The **D Part Variants** section will display the associated part(s) for the mold. When a mold record is created or edited, an existing part record(s) can be selected to create the part/mold association; refer to "Create a New Mold Record" on page 48 or "Edit a Mold Record" on page 49 for information on associating a part and mold.

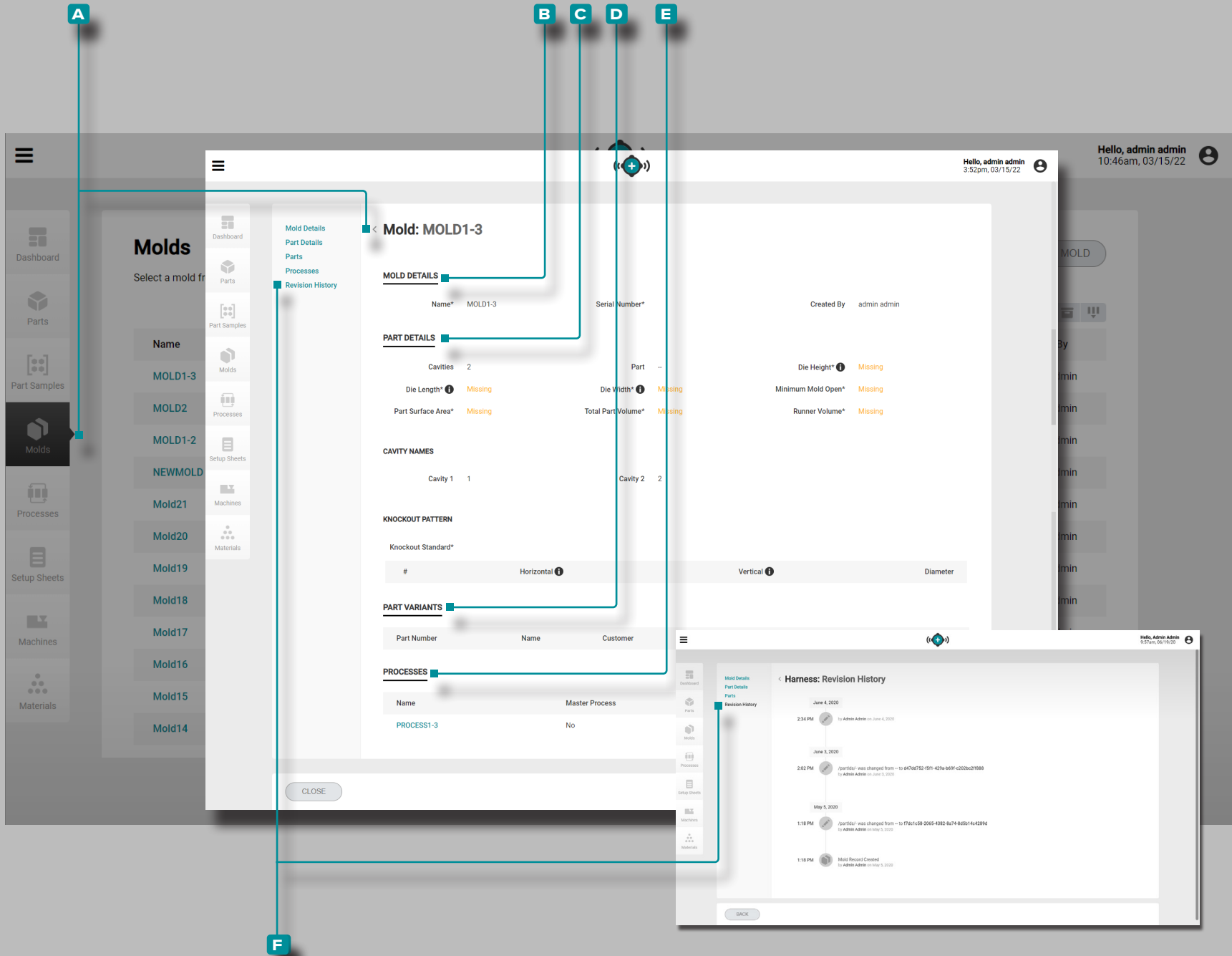
Processes

The **E Processes** section will display the associated process(es) for the mold. When a setup sheet is created, molds are associated with a process(es); refer to "Launch a New Mold" on page 82 or "Transfer a Mold" on page 84.

Revision History

The **F Revision History** is a log of user-initiated actions that occur within the software, providing a record of each user action related to the record while logged in. **Click** on the **F Revision History** heading to view the mold record revision history. Refer to "Comparing Record Revision History" on page 33 for information on comparing record revisions.

NOTE *Revision History is visible only to the users designated with administrator and process engineer roles.*



The Hub for Process Development

Create a New Mold Record

Click the **A** **CREATE A NEW MOLD** button on the Molds records page.

Enter the **B** **mold details** (name, serial number, number of cavities, part, die height, die length, die width, minimum mold open (**these are required fields**); the Created By field will automatically populate with the current user's name).

The appropriate number of cavity names fields will appear after the number of cavities field is completed. Optionally, **enter** the cavity names; the fields are automatically filled using numbers and do not require editing if no names are used.

Click the **C** **knockout standard** drop-down menu to select Euromap, SPI, or Center for the mold Knockout Pattern; **enter** the horizontal, vertical, and center dimensions where applicable. If the knockout is symmetrically-located, select the mirror check box to automatically duplicate the mirrored knockout of the mold.

Enter the physical **D** **part details** (part surface area, part volume, and runner volume (**these fields—except number of cavities—are required for process transfer features**).

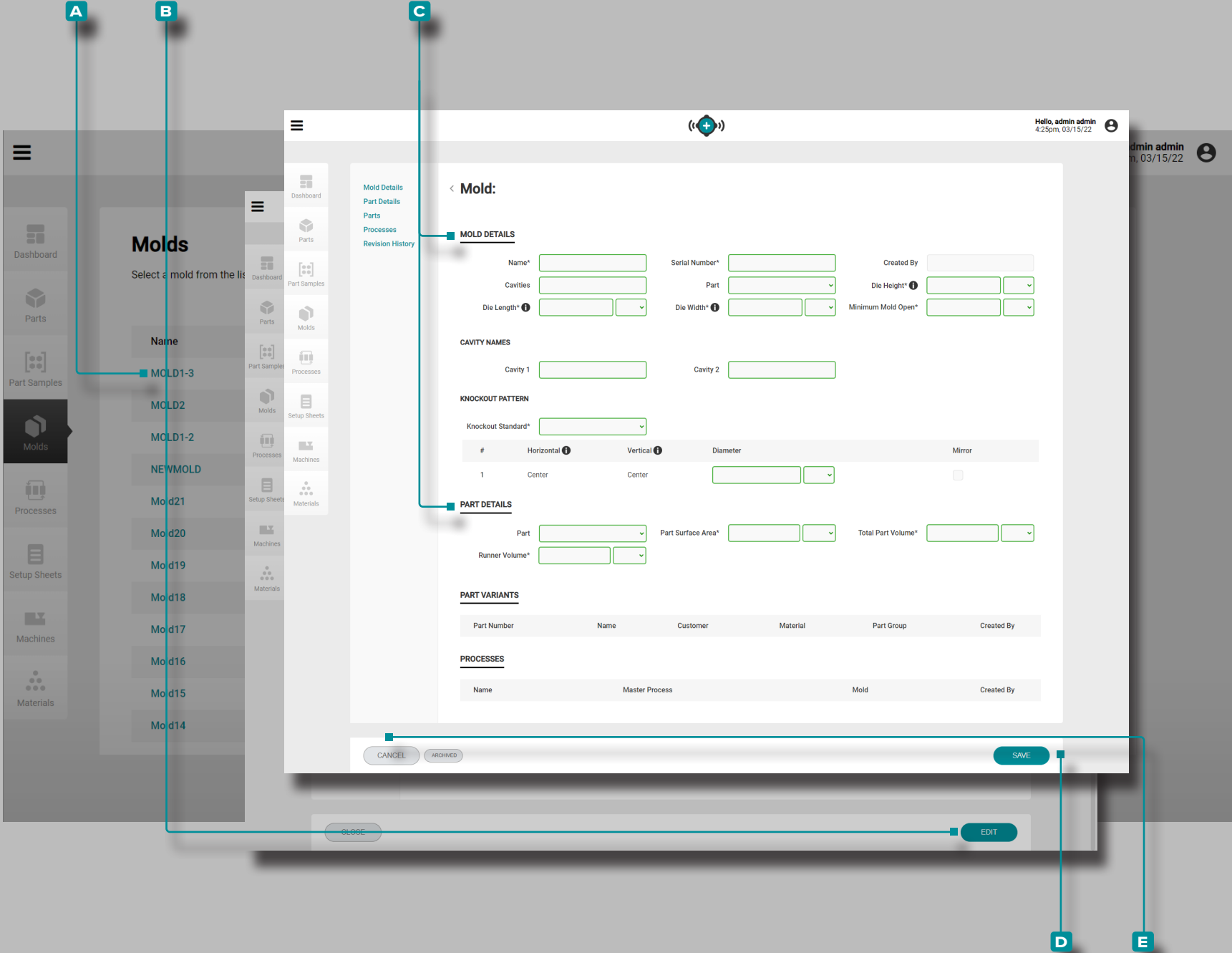
A part must be selected in order for part/part variants to be associated with the mold, and enable use of the part sample features.

Click on a **E** **part** or parts to associate a part record with the mold record.

Click the **G** **SAVE** button to save the part record, or the **F** **CANCEL** button to exit without saving the record.

The screenshot shows the 'Molds' application interface. On the left is a sidebar with navigation icons for Dashboard, Parts, Part Samples, Molds, Processes, Setup Sheets, Machines, and Materials. The main content area is titled 'Molds' and includes a '+ CREATE A NEW MOLD' button. Below this is a list of mold records: MOLD1-3, MOLD2, MOLD1-2, NEWMOLD, Mold21, Mold20, Mold19, Mold18, Mold17, Mold16, Mold15, and Mold14. A modal window is open for creating a new mold record. It has tabs for 'Mold Details', 'Part Details', 'Part Variants', and 'Processes'. The 'Mold Details' tab is active and contains fields for Name*, Serial Number*, Created By, Cavities, Part, Die Height*, Die Length*, Die Width*, and Minimum Mold Open*. Below these are 'CAVITY NAMES' fields for Cavity 1 and Cavity 2. The 'KNOCKOUT PATTERN' section has a 'Knockout Standard*' dropdown and a table with columns for #, Horizontal, Vertical, Diameter, and Mirror. The 'PART DETAILS' section has fields for Part, Part Surface Area*, Total Part Volume*, and Runner Volume*. The 'PART VARIANTS' section is a table with columns for Part Number, Name, Customer, Material, Part Group, and Created By. The 'PROCESSES' section is a table with columns for Name, Master Process, Mold, and Created By. At the bottom of the modal are 'CANCEL' and 'SAVE' buttons. Callout letters A through G point to the following elements: A points to the '+ CREATE A NEW MOLD' button; B points to the 'Name*' field; C points to the 'Knockout Standard*' dropdown; D points to the 'Part' field; E points to a part record in the 'PART VARIANTS' table; F points to the 'CANCEL' button; and G points to the 'SAVE' button.

The Hub for Process Development

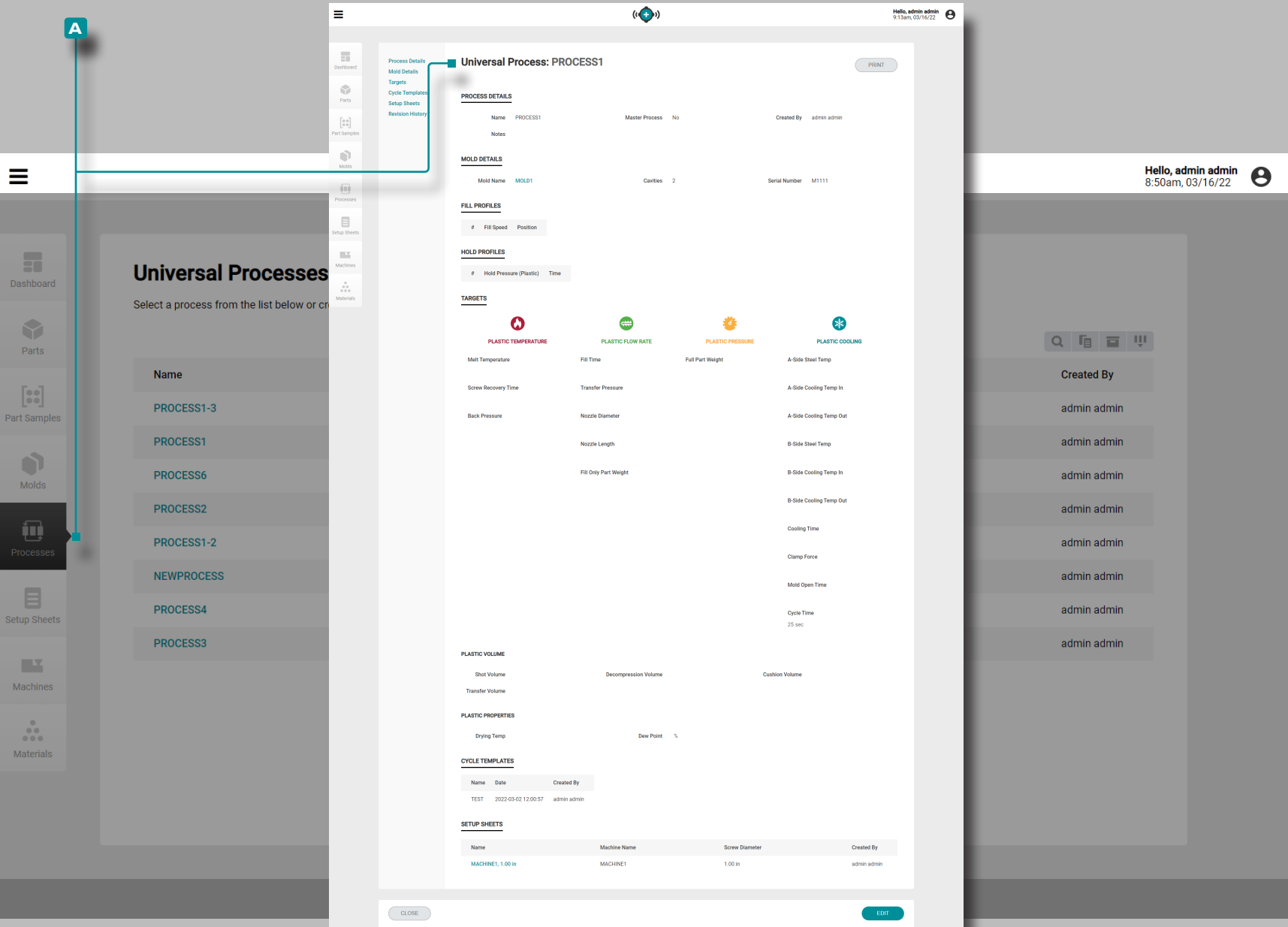


Edit a Mold Record

Click the **A** mold name to view the mold record on the Molds records page. Click the **B** EDIT button to edit the mold details.

Edit the **C** mold details, physical part details.

Click the **D** SAVE button to save the mold record, or the **E** CANCEL button to exit without saving the record.



The Hub for Process Development

Processes

Process Records

Process records contain machine-independent variables; therefore, processes are created and saved for use across machines *provided the machine is compatible with the selected mold and process requirements*. Additionally, processes are **only generated using the “Launch a New Mold” feature**—once a process is generated for a new mold launch, it can be selected later for use with the “Transfer a Mold” feature.

NOTE *Process record variables are entered and displayed in volumetric units and plastic pressure units.*

Process records **A** are shown on the Processes page. Click **A** on a process record to view Process Details, associated Mold Details, associated Material Details, Fill Profiles, Hold Profiles, process Targets, associated Setup Sheets, and Revision History. **Process records** **A** can also be compared to one another using the compare records feature; refer to "Comparing Records" on page 32 for information on comparing records.

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The Hub for Process Development

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Process Details

Process Details B contains the process name, which is automatically generated by the system from the part number and mold name, if the process has been marked as the "Master Process, created by, and notes.

Mold Details

Mold Details C contains the associated mold record's details (refer to "Mold Records" on page 46 for information on mold records).

Fill Profiles

Fill Profiles D are created when a process is created or generated; fill profiles include number, speed, and position values.

Hold Profiles

Hold Profiles E are created when a process is created or generated; hold profiles include number, hold pressure (plastic), and time values.

Targets

Targets F are created when a process is created or generated; targets include plastic: volume, temperature, flow, pressure, and cooling-related values.

Cycle Templates

Cycle Templates G contains the associated cycle template(s) for the process.

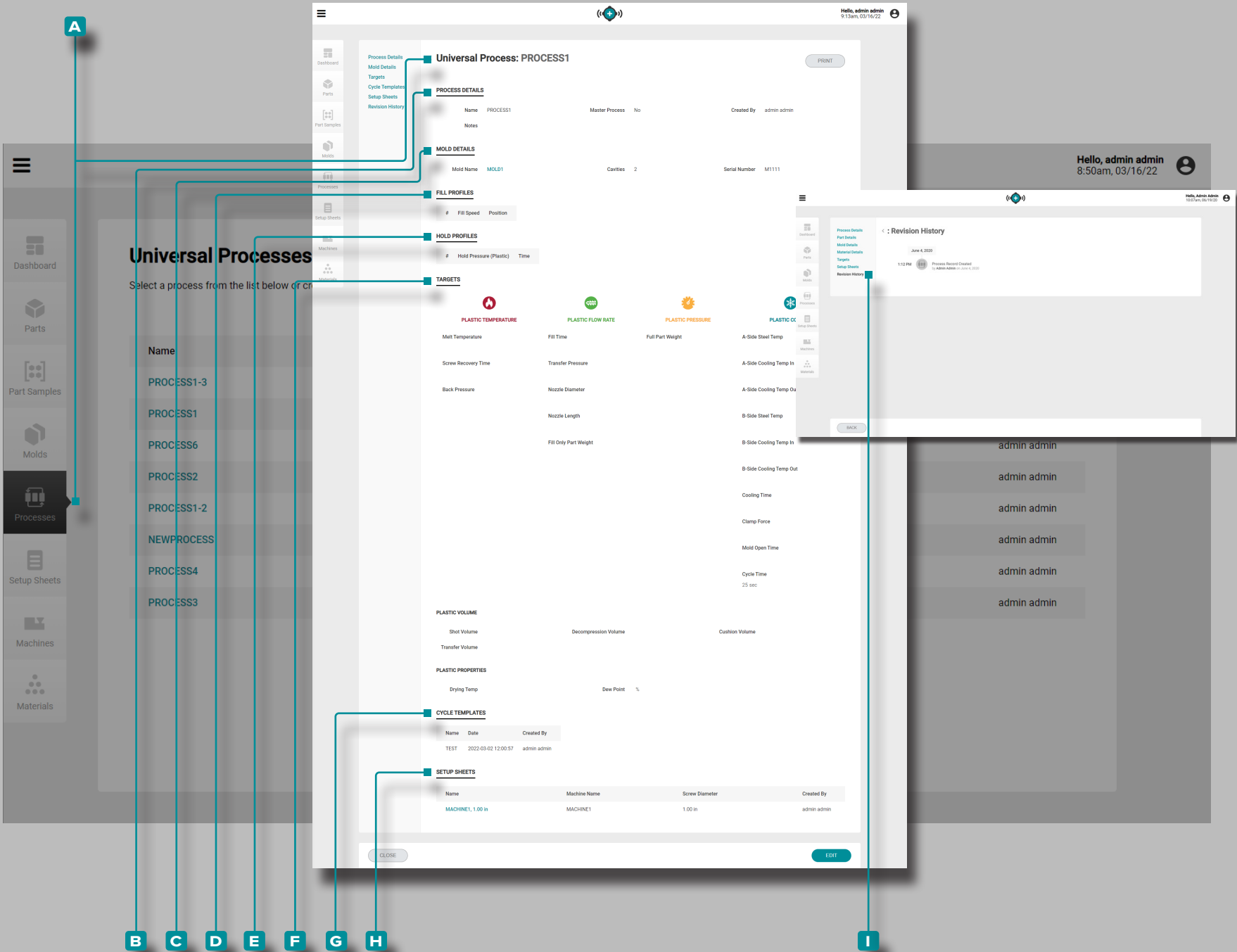
Setup Sheets

Setup Sheets H contains the associated setup sheets (refer to "Setup Sheet Records" on page 54 for information on setup sheet records).

Revision History

The **I Revision History** is a log of user-initiated actions that occur within the software, providing a record of each user action related to the record while logged in. **Click** on the **I Revision History** heading to view the process record revision history. Refer to "Comparing Record Revision History" on page 33 for information on comparing record revisions.

NOTE *Revision History is visible only to the users designated with administrator and process engineer roles.*



The Hub for Process Development

Create a New Process Record

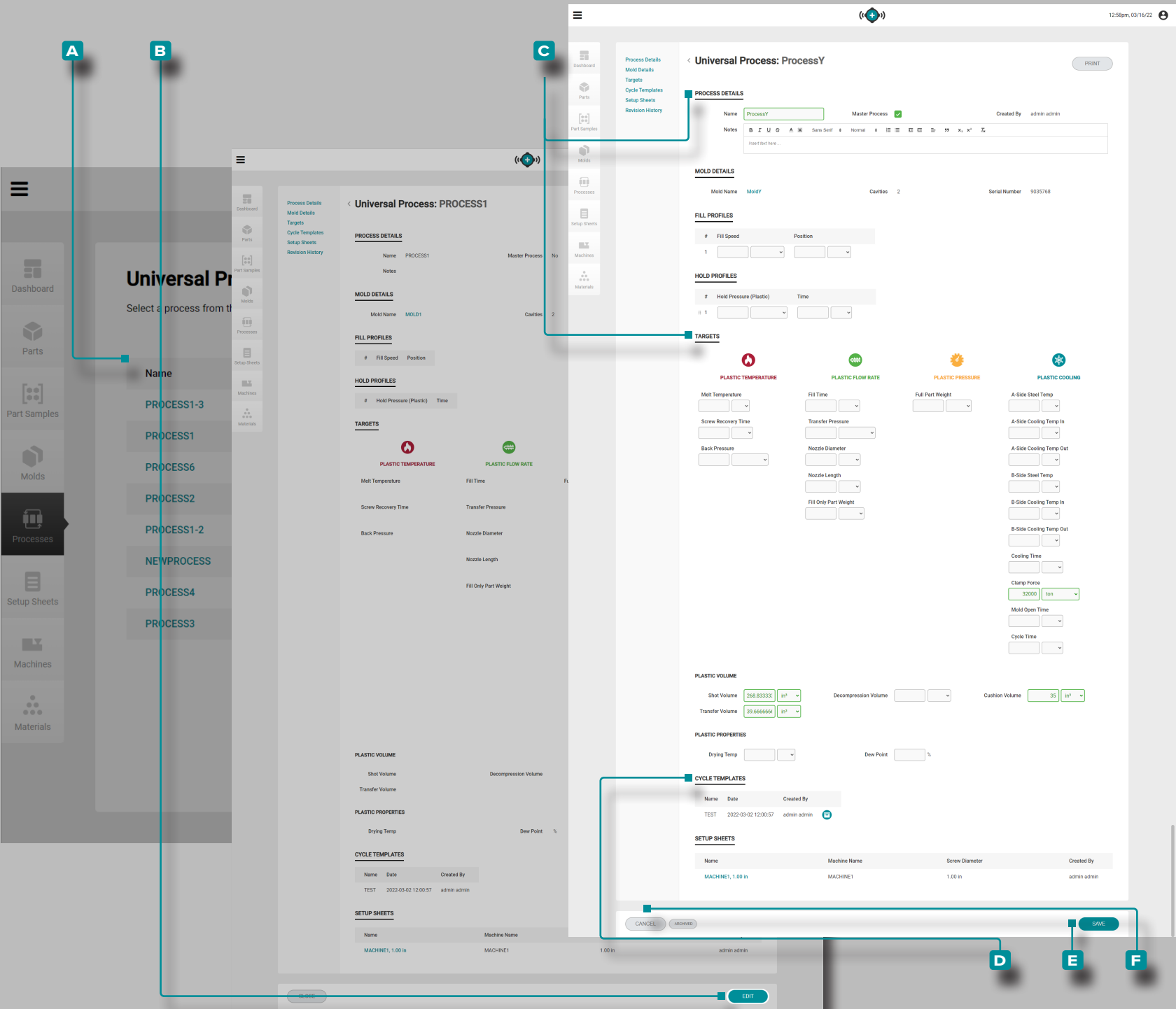
Process records are created only through the Launch a New Mold tool located on the dashboard; refer to "Launch a New Mold" on page 82 for information on the Launch a New Mold tool.

Edit a Process Record

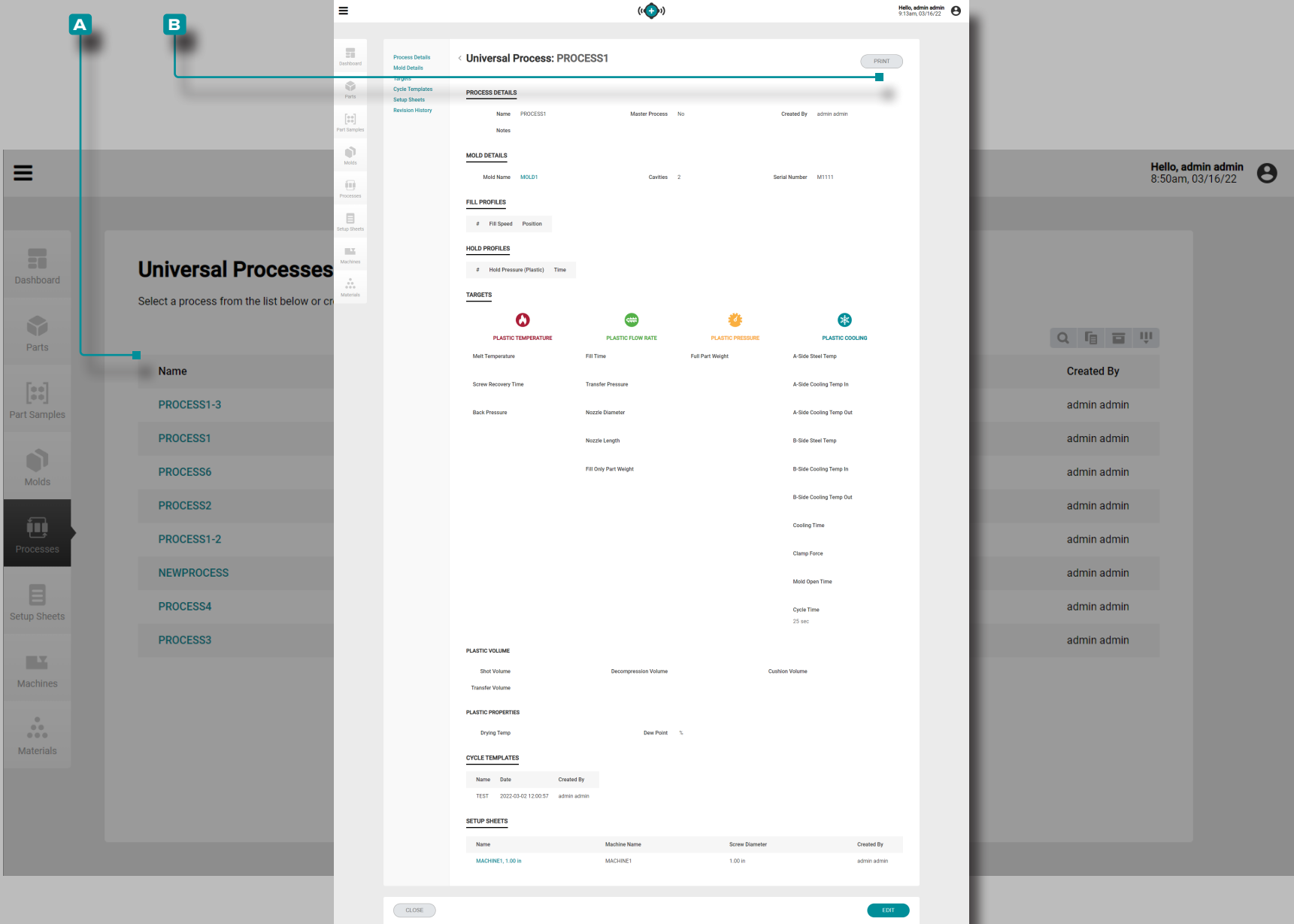
Click the **A** process name to view the process record on the Processes records page. Click the **B** EDIT button to edit the process record.

Edit the **C** process details or targets, or archive/un-archive **D** cycle templates. Other process record items (associated molds and setup sheets) cannot be edited from the processes page and must be edited from the individual molds or setup sheets records pages.



Click the **E** SAVE button to save the process record, or the **F** CANCEL button to exit without saving the record.



The Hub for Process Development



Print Process Record

Click  the **A** process name to view the process record on the Processes records page. Click  the **B** PRINT button to print the process record.

The Hub for Process Development

Setup Sheets

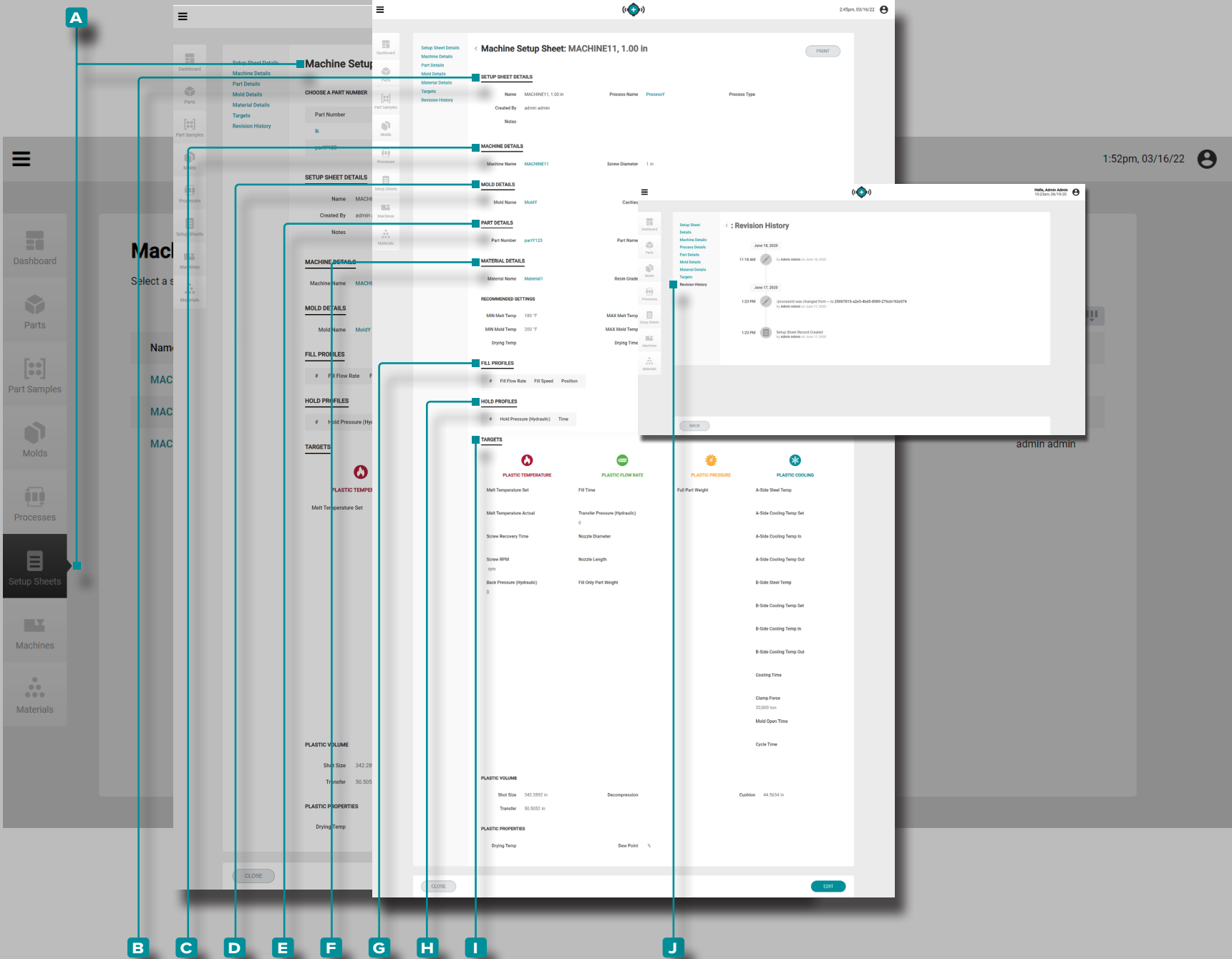
Setup Sheet Records

Setup sheets include specific, machine-dependent values that are used *only* with a specific part-mold-machine-process combination and therefore are generated by the “Launch a New Mold” or “Transfer a Mold” features only after all other records are created/selected. **Setup Sheets are mold-specific.**

NOTE *Setup sheet record variables can be displayed/entered in volume or linear units, and plastic pressure or hydraulic pressure units.*

Setup sheet **A** records are shown on the Setup Sheets page. Click **A** on a setup sheet record name, then click **A** on a part variant (if applicable) to view Setup Sheet Details, Machine Details, associated Part Details, associated Mold Details, associated Material Details including recommended settings, process Targets, and Revision History. Setup sheet records **A** can also be compared to one another using the compare records feature; refer to "Comparing Records" on page 32 for information on comparing records.

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The Hub for Process Development

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Setup Sheet Details

Setup Sheet Details B contains the setup sheet name, the associated process record name, process type, and created by.

Machine Details

Machine Details C contains the associated machine name, and the machine's screw diameter.

Part Details

Part Details D contains the associated part record's details (refer to "Part Records" on page 38 for information on part records).

Mold Details

Mold Details E contains the associated mold record's details (refer to "Mold Records" on page 46 for information on mold records).

Material Details

Material Details F contains the associated material record's details (refer to "Material Records" on page 64 for information on material records).

Fill Profiles

Fill Profiles G contains any fill profiles added to the setup sheet.

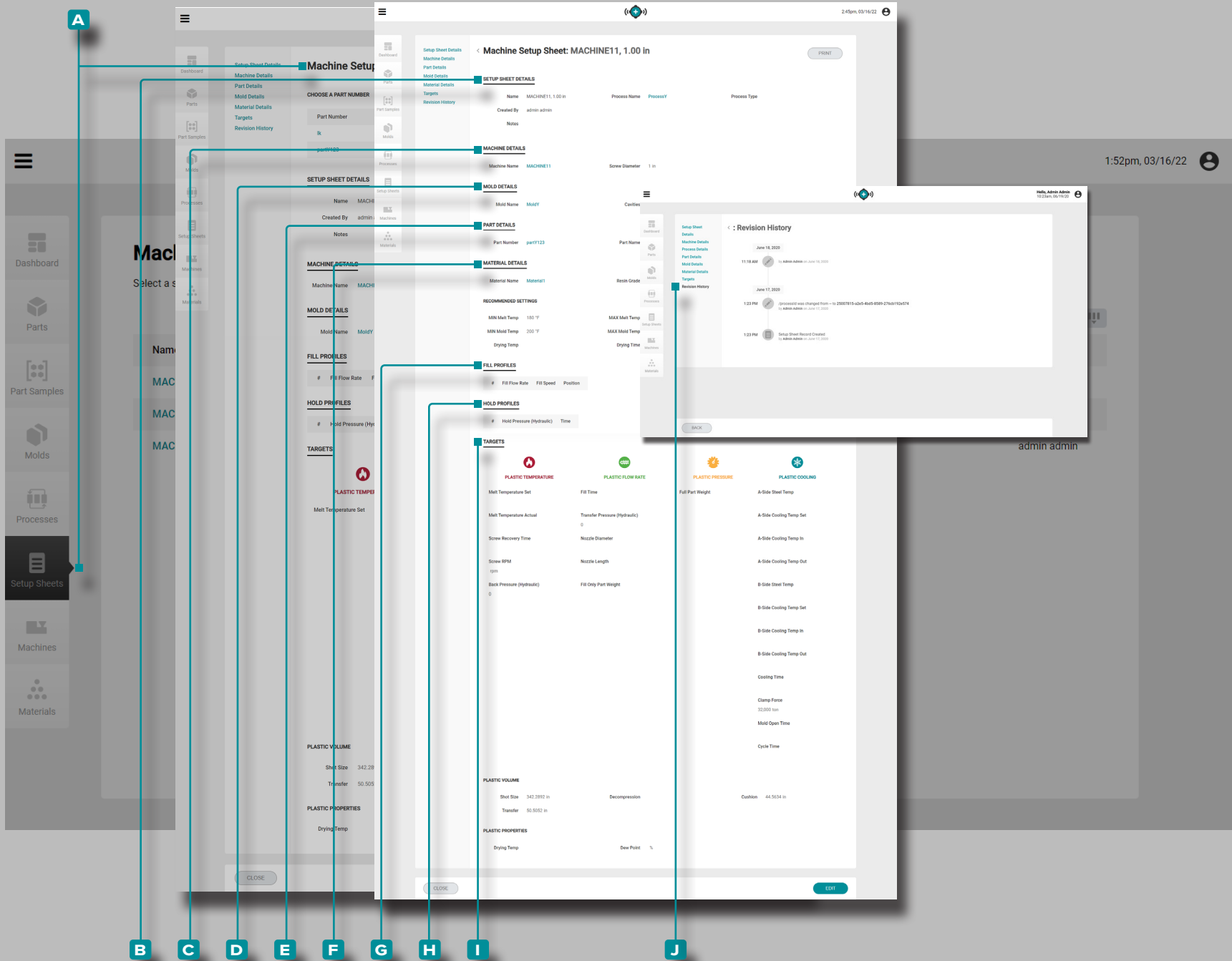
Hold Profiles

Hold Profiles H contains any hold profiles added to the setup sheet.

Targets

Targets I are created when a process is created or generated; targets include plastic: volume, temperature, flow, pressure, and cooling-related values.


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The Hub for Process Development

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Revision History

The **J Revision History** is a log of user-initiated actions that occur within the software, providing a record of each user action related to the record while logged in. **Click**  on the **J Revision History** heading to view the setup sheet record revision history. Refer to "Comparing Record Revision History" on page 33 for information on comparing record revisions.

NOTE *Revision History is visible only to the users designated with administrator and process engineer roles.*

The Hub for Process Development

Create a New Setup Sheet Record

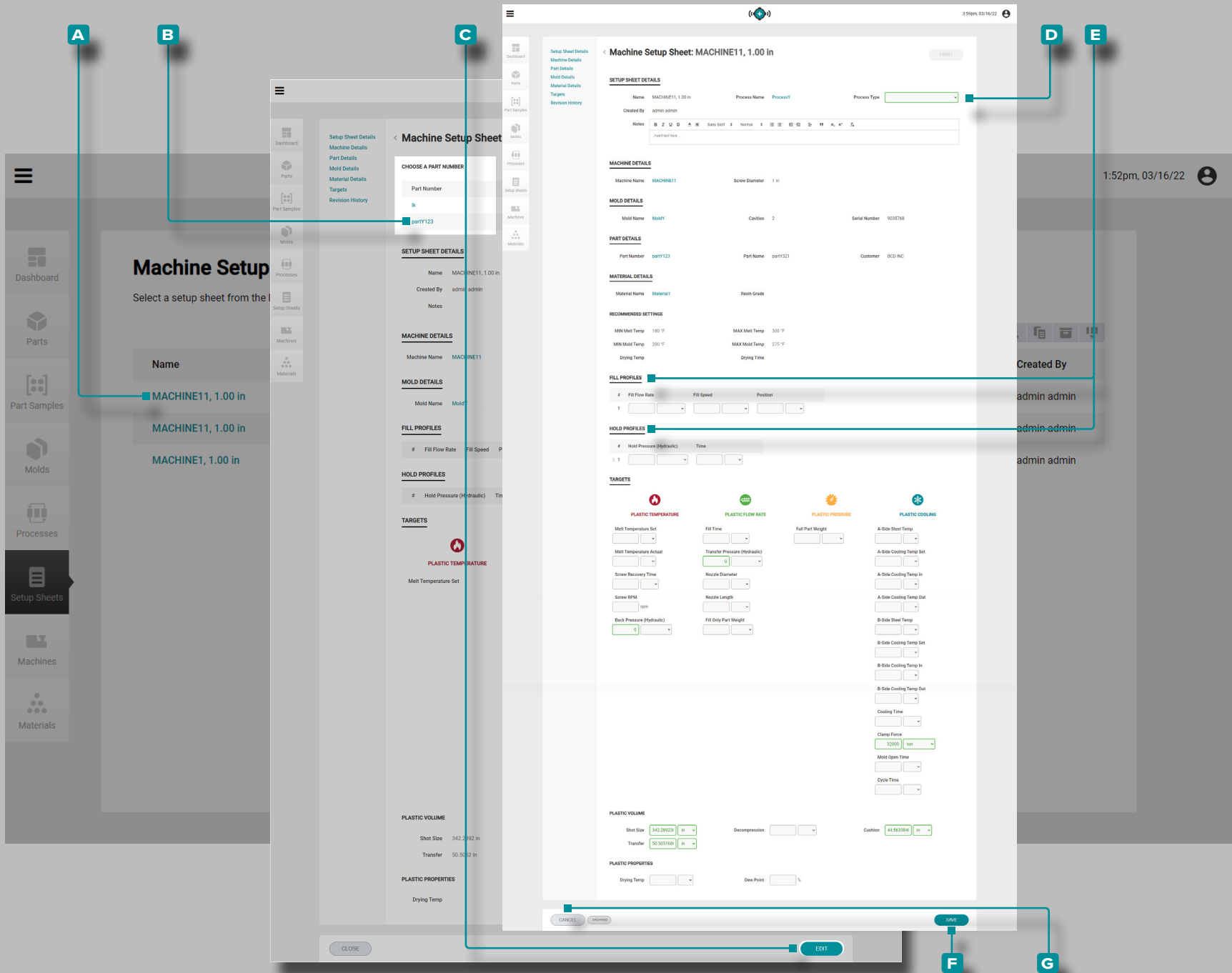
Setup Sheet records are created only through the Launch a New Mold or Transfer a Mold tools located on the dashboard; refer to "Launch a New Mold" on page 82 for information on the Launch a New Mold tool or "Transfer a Mold" on page 84 for information on the Transfer a Mold tool.

Edit a Setup Sheet Record

Click the **A** setup sheet name to view the setup sheet record on the Setup Sheets records page. Optionally, click to select a **B** part variant to edit the setup sheet record for that variant. Click the **C** EDIT button to edit the setup sheet record.

Edit the **D** process type, **E** fill and/or hold profiles, or targets. Other process record items (associated parts, associated molds, materials, and processes) cannot be edited from the setup sheets page and must be edited from the individual parts, molds, materials, or processes records pages.

Click the **F** SAVE button to save the setup sheet record, or the **G** CANCEL button to exit without saving the record.



The Hub for Process Development

Dashboard

Parts

Part Samples

Molds

Processes

Setup Sheets

Machines

Materials

Machine Setup Sheets

Select a setup sheet from the list below or create a new one.

Name

MACHINE11, 1.00 in

MACHINE11, 1.00 in

MACHINE1, 1.00 in

Machine Setup Sheet: MACHINE11, 1.00 in

Setup Sheet Details

Part Details

Mold Details

Material Details

Targets

Revision History

SETUP SHEET DETAILS

Name

MACHINE11, 1.00 in

Process Name

Process1

Process Type

Created By

admin admin

Notes

MACHINE DETAILS

Machine Name

MACHINE11

Screw Diameter

1 in

MOLD DETAILS

Mold Name

MoldY

Cavities

2

Serial Number

9035768

PART DETAILS

Part Number

partY123

Part Name

partY321

Customer

BCD INC

MATERIAL DETAILS

Material Name

Material1

Resin Grade

RECOMMENDED SETTINGS

MIN Melt Temp

150 °F

MAX Melt Temp

350 °F

MIN Mold Temp

200 °F

MAX Mold Temp

275 °F

Drying Temp

Drying Time

FILL PROFILES

#Fill Flow RateFill SpeedPosition

HOLD PROFILES

#Hold Pressure (Hydraulic)Time

TARGETS

PLASTIC TEMPERATURE

PLASTIC FLOW RATE

PLASTIC PRESSURE

PLASTIC COOLING

Melt Temperature Set

Fill TimeFull Part WeightA-Side Steel Temp

Melt Temperature Actual

Transfer Pressure (Hydraulic)A-Side Cooling Temp Set

Screw Recovery Time

Nozzle DiameterA-Side Cooling Temp In

Screw RPM

Nozzle LengthA-Side Cooling Temp Out

Back Pressure (Hydraulic)

Fill Only Part WeightB-Side Steel Temp

B-Side Cooling Temp Set

B-Side Cooling Temp In

B-Side Cooling Temp Out

Cooling Time

Clamp Force

32,000 lbf

Mold Open Time

Cycle Time

PLASTIC VOLUME

Shot Size

343.2892 in

Decompression

Cushion

44.5034 in

Transfer

50.5052 in

PLASTIC PROPERTIES

Drying Temp

Dew Point

%

CLOSE

EDIT

1:52pm, 03/16/22

Created By

admin admin

admin admin

admin admin

Print Setup Sheet Record

Click the **A** setup sheet name to view the setup sheet record on the Setup Sheets records page. Click the **B** PRINT button to print the setup sheet record.

The Hub for Process Development

Machines

Machine Records

Machine Records A are shown on the Machines page. **Click** on a machine name to view Machine Details, Clamp Unit, Tie Bar dimensions, Injection Unit, barrel assemblies, and revision history. **Machine Records A** can also be compared to one another using the compare records feature; refer to "Comparing Records" on page 32 for information on comparing records.

Machine Details

Machine Details B contains the machine name, manufacturer, model, and serial number, and created by.

Clamp Unit

Clamp Unit C details include the clamp unit's physical details, including tie bar and knockout pattern information.

Injection Unit

Injection Unit D details include the injection unit's physical details, including machine setpoint quantities and display units.

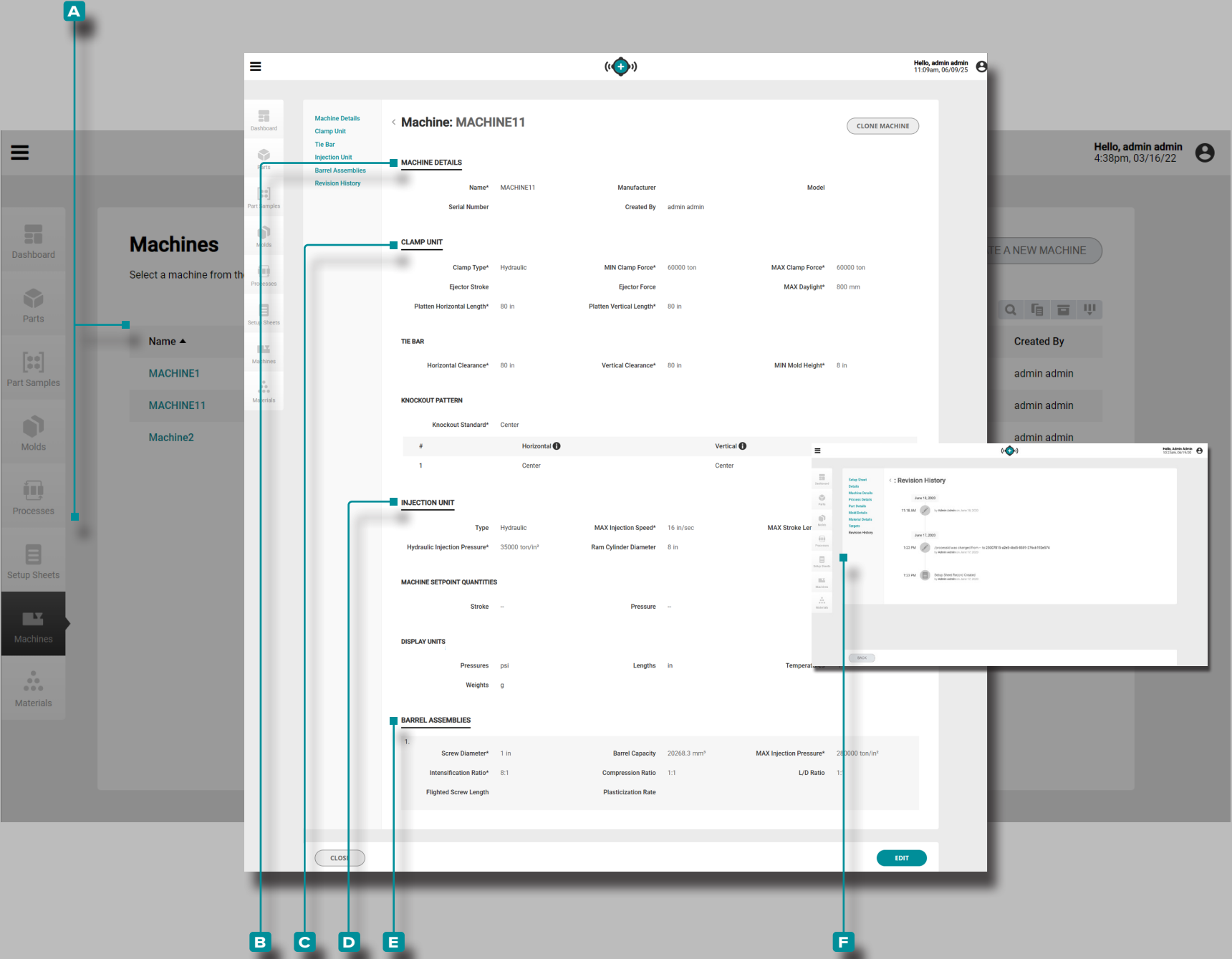
Barrel Assemblies

Barrel Assemblies E includes the available barrel assemblies which can be used in the injection molding machine.

Revision History

The **F Revision History** is a log of user-initiated actions that occur within the software, providing a record of each user action related to the record while logged in. **Click** on the **F Revision History** heading to view the machine record revision history. Refer to "Comparing Record Revision History" on page 33 for information on comparing record revisions.

NOTE *Revision History is visible only to the users designated with administrator and process engineer roles.*

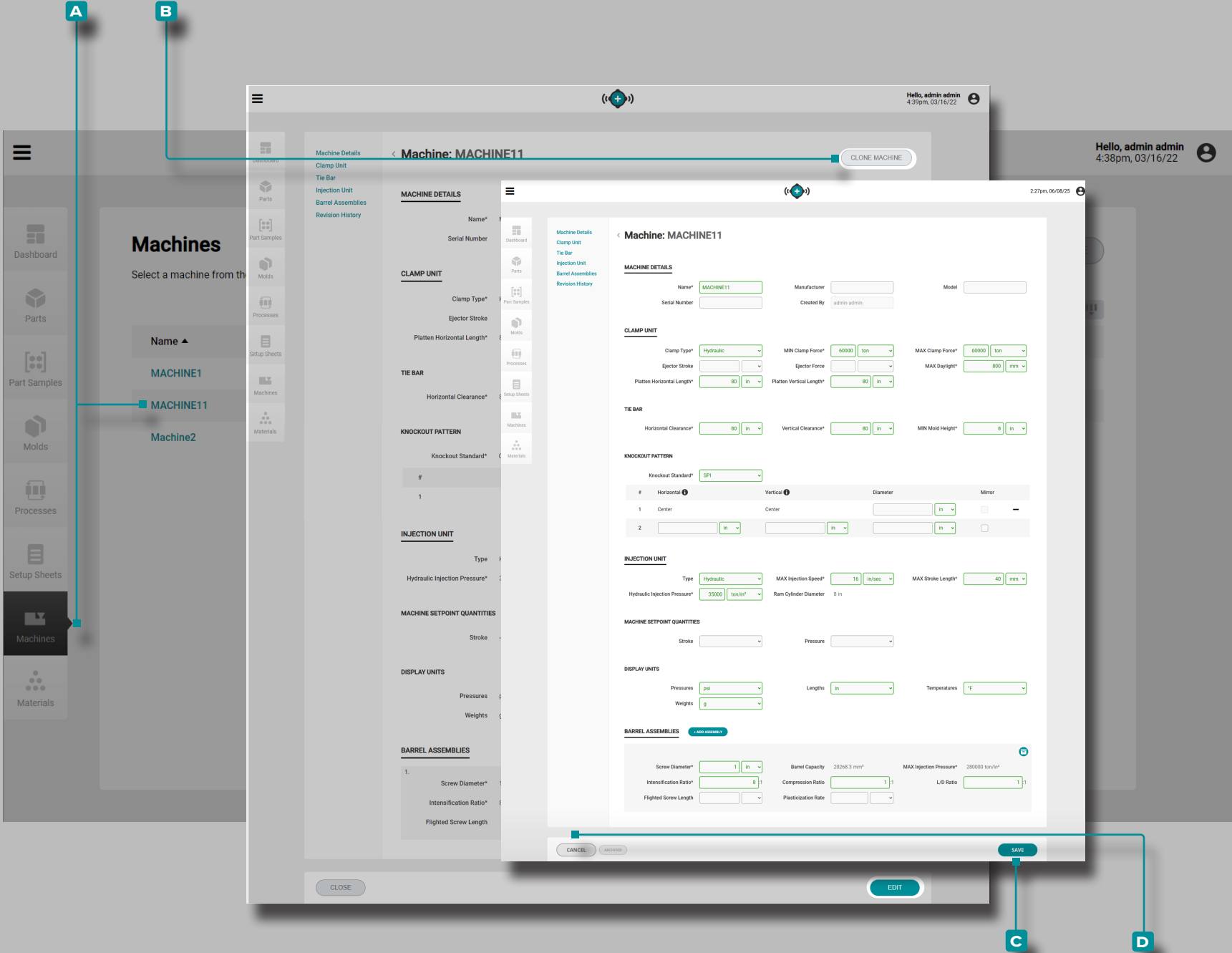


The Hub for Process Development

Create a New Machine Record

- Click the **A** **CREATE A NEW MACHINE** button on the Machines records page.
 - Enter the **B** **machine details** (machine name (**this is a required field**), manufacturer, model, and serial number; the created by field will automatically populate with the current user's name).
 - Enter the physical **C** **clamp unit details** (clamp type*, opening stroke*, minimum and maximum clamp force*, ejector stroke, ejector force, and platten horizontal and vertical lengths*).
 - Enter the physical **D** **tie bar details** (horizontal and vertical clearance*, and maximum and minimum mold height*).
 - Click the **E** **knockout pattern** drop-down menu and select a mold knockout pattern* (euromap, SPI, or center).
 - Enter the **E** **knockout pattern details** (horizontal, vertical, and center). If the knockout is symmetrically-located, select the mirror check box to duplicate the mirrored knockout. To remove a knockout pattern, click the **F** **minus button**; center knockouts can only be removed when euromap or SPI are selected.
 - Enter the physical **G** **injection unit details** (type, maximum injection speed*, and maximum stroke length*. **select** the machine setpoint quantities (linear or volumetric) and display units for pressures, lengths, temperatures, and weights.
 - Click the **H** **+ADD ASSEMBLY** to add and **enter** the physical **I** **barrel assembly details** (screw diameter*, maximum injection pressure*, compression ratio, L/D ratio, flighted screw length, and plastication rate).
 - Click the **J** **SAVE** button to save the machine record, or the **K** **CANCEL** button to exit without saving the record.
- *THESE FIELDS ARE REQUIRED FOR PROCESS TRANSFER FEATURES.

The Hub for Process Development



Clone a Machine

If there are multiple of the same model machine from a manufacturer, machines can quickly be cloned to quickly create machine records.

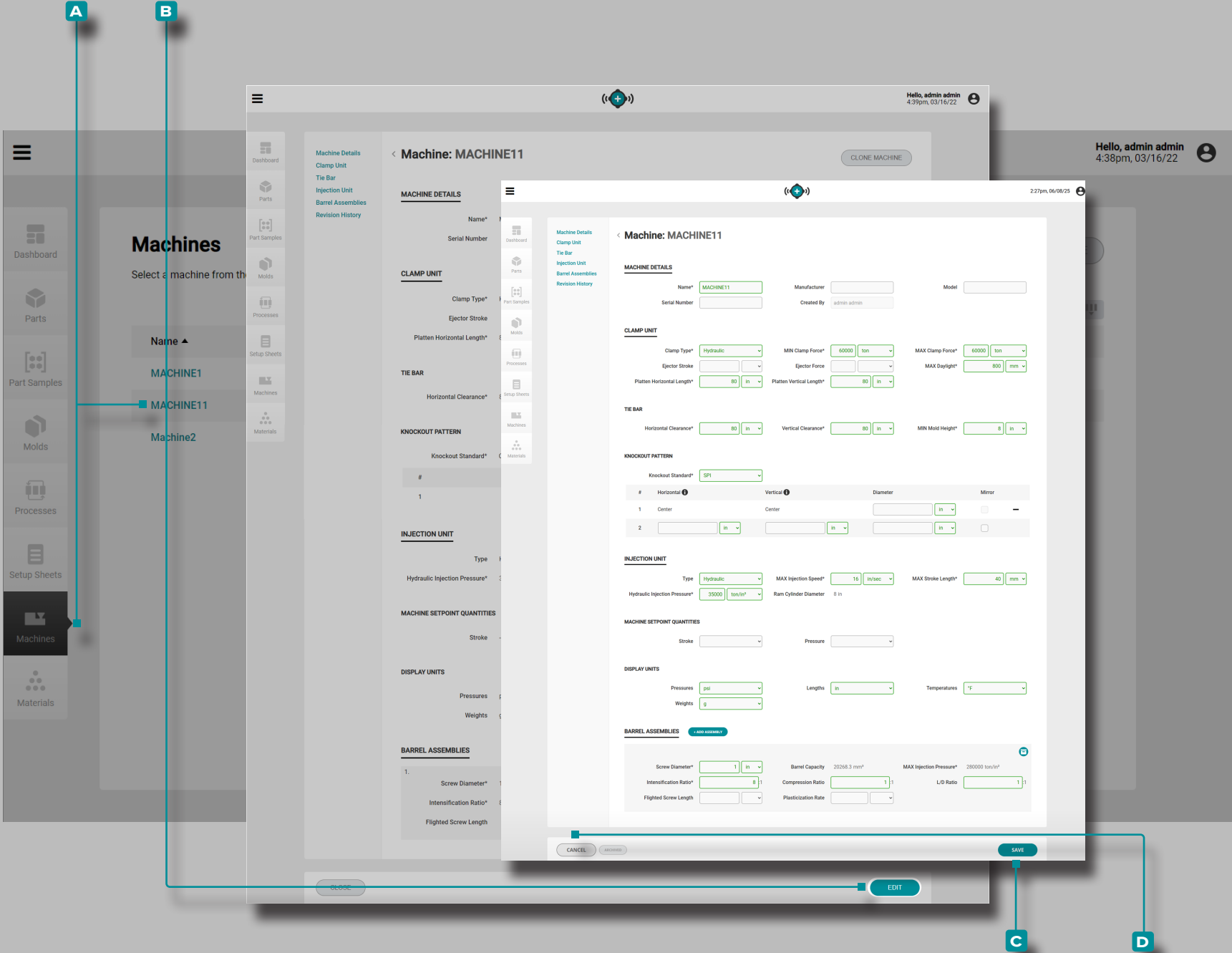
Click the **A** machine name to view the machine record on the Machines records page. Click the **B** CLONE MACHINE button to edit the machine details.

Enter a new machine name (this is required).

If necessary, edit the machine details, physical clamp unit details, tie bar details, physical injection unit details, barrel assemblies, or select/deselect a barrel assembly to associate/disassociate a barrel assembly record with the machine record.

Click the **C** SAVE button to save the machine record, or the **D** CANCEL button to exit without saving the record.

The Hub for Process Development



Edit a Machine Record

Click the **A** machine name to view the machine record on the Machines records page. Click the **B** EDIT button to edit the machine details.

Edit the machine details, physical clamp unit details, tie bar details, physical injection unit details, barrel assemblies, or select/deselect a barrel assembly to associate/disassociate a barrel assembly record with the machine record.

Click the **C** SAVE button to save the machine record, or the **D** CANCEL button to exit without saving the record.

The Hub for Process Development

Add or Archive a Barrel Assembly

Click the **A** machine name to view the machine record On the Machines records page. Click the **B** EDIT button to edit the machine details.

Click the **C** ADD ASSEMBLY button next to the Barrel Assemblies heading; enter the barrel assembly details (**all barrel assembly fields are required for process transfer features**).

OR

Click the **D** Archive button in the upper right-hand corner of a barrel assembly to archive (or un-archive) the assembly. Archiving a barrel assembly saves the assembly for future use, but enables another barrel assembly to be used with the machine.

Click the **E** SAVE button to save the machine record, or the **F** CANCEL button to exit without saving the record.

The screenshot displays the 'Machine: MACHINE11' configuration interface. It features a sidebar with navigation options: Dashboard, Parts, Part Samples, Molds, Processes, Setup Sheets, Machines, and Materials. The main content area is divided into sections for Machine Details, Clamp Unit, Tie Bar, Knockout Pattern, Injection Unit, Machine Setpoint Quantities, Display Units, and Barrel Assemblies. Callouts A-F highlight specific elements: A points to the 'MACHINE11' name in the Machines list; B points to the 'EDIT' button at the bottom; C points to the '+ ADD ASSEMBLY' button; D points to the 'Archive' button in the top right of the Barrel Assemblies section; E points to the 'SAVE' button at the bottom right; and F points to the 'CANCEL' button at the bottom left. The 'Barrel Assemblies' section includes fields for Screw Diameter, Intensification Ratio, Flighted Screw Length, Barrel Capacity, Compression Ratio, Plasticization Rate, MAX Injection Pressure, and L/D Ratio.

The Hub for Process Development

Materials

Material Records

Material records **A** are shown on the Materials page.

Click **A** on a material name to view Material Details, properties, temperatures, and revision history. Material records **A** can also be compared to one another using the compare records feature; refer to "Comparing Records" on page 32 for information on comparing records.

Material Details

Material Details **B** contains the material name, manufacturer, and created by.

Properties

Material Properties **C** contains the material physical properties (resin grade, percent regrind, color, tonnage, maximum residence time, additives (additives entered must be separated by commas)).

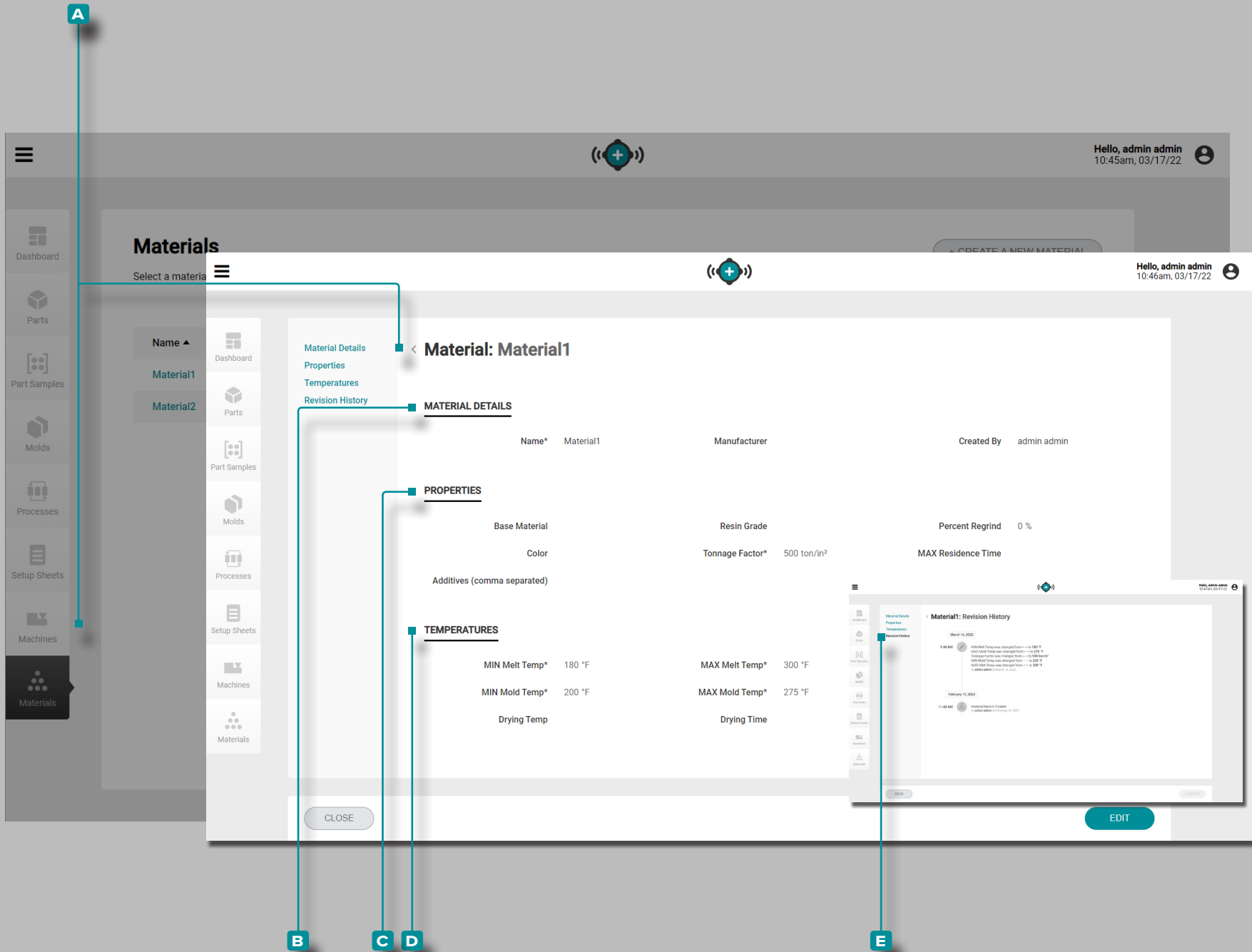
Temperatures

Material Temperatures **D** contains the processing temperature information (minimum melt temperature, maximum melt temperature, minimum mold temperature, maximum mold temperature, drying temperature, and drying time).

Revision History

The **E** Revision History is a log of user-initiated actions that occur within the software, providing a record of each user action related to the record while logged in. Click **E** on the **E** Revision History heading to view the material record revision history. Refer to "Comparing Record Revision History" on page 33 for information on comparing record revisions.

NOTE Revision History is visible only to the users designated with administrator and process engineer roles.



The Hub for Process Development

The screenshot shows a web application for managing materials. A sidebar on the left contains navigation icons for Dashboard, Parts, Part Samples, Molds, Processes, Setup Sheets, Machines, and Materials. The main content area is titled 'Materials' and includes a '+ CREATE A NEW MATERIAL' button. Below this is a modal form for creating a new material record. The form has three tabs: 'Material Details', 'Properties', and 'Temperatures'. The 'Material Details' tab is active, showing fields for Name, Manufacturer, and Created By. The 'Properties' tab shows fields for Base Material, Resin Grade, Percent Regrind, Color, Tonnage Factor, MAX Residence Time, and Additives. The 'Temperatures' tab shows fields for MIN Melt Temp, MAX Melt Temp, MIN Mold Temp, MAX Mold Temp, Drying Temp, and Drying Time. Callout letters A through F point to specific elements: A points to the '+ CREATE A NEW MATERIAL' button; B points to the 'Material Details' tab; C points to the 'Properties' tab; D points to the 'Temperatures' tab; E points to the 'SAVE' button; and F points to the 'CANCEL' button.

A + CREATE A NEW MATERIAL

B Material Details

C Properties

D Temperatures

E SAVE

F CANCEL

Create a New Material Record

Click **A** the **CREATE A NEW MATERIAL** button on the Materials records page.

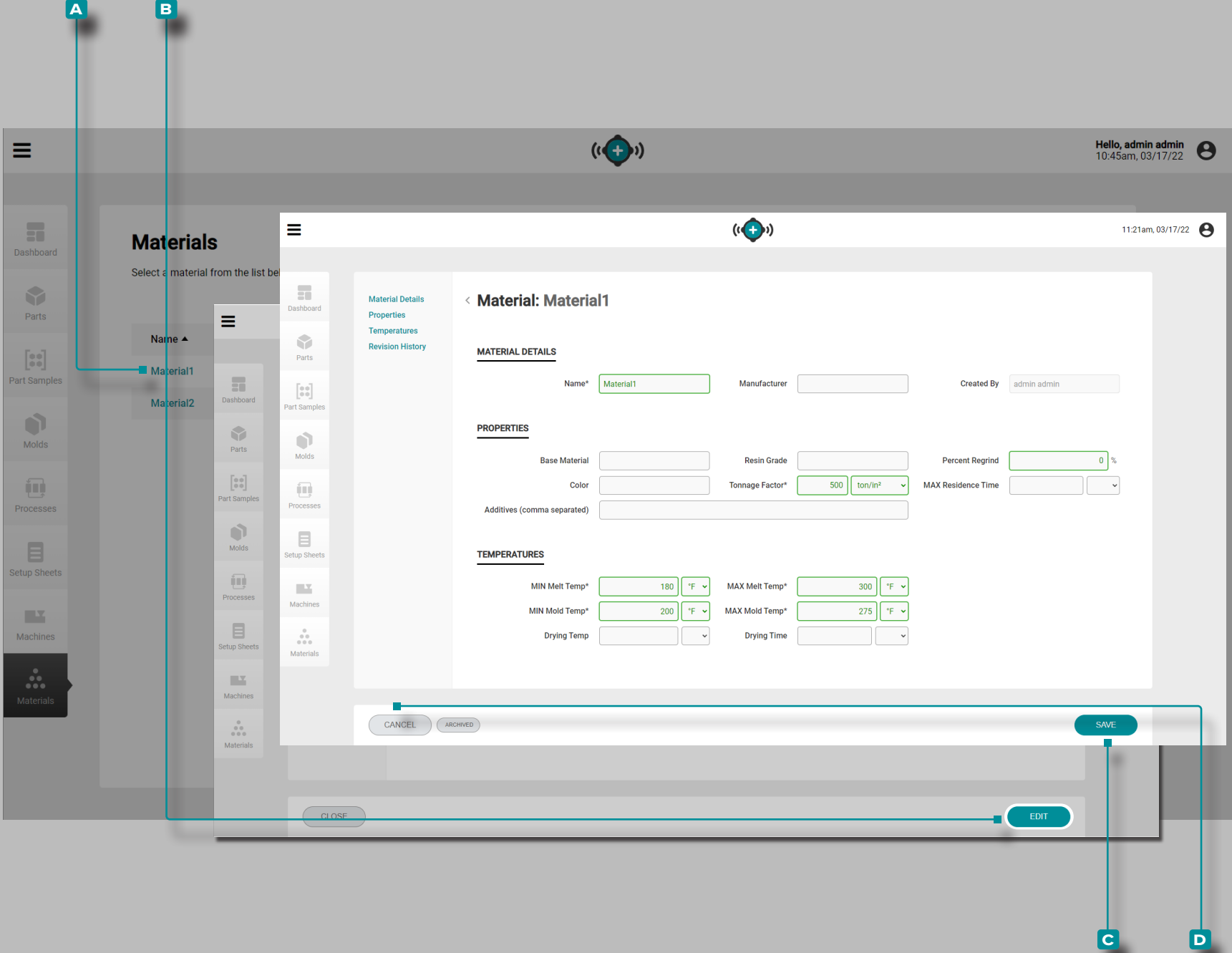
Enter **B** the **material details** (material name (**this is a required field**) and manufacturer; the created by field will automatically populate with the current user's name).

Enter **C** the **material properties** (base material, resin grade, percent regrind, color, tonnage factor (**this fields is required for process transfer features**), maximum residence time, and additives (additives entered must be separated by commas)).

Enter **D** the **material temperatures** information (minimum melt temperature, maximum melt temperature, minimum mold temperature, maximum mold temperature (**these fields are required for process transfer features**), and drying temperature and drying time).

Click **E** the **SAVE** button to save the material record, or the **F** **CANCEL** button to exit without saving the record.

The Hub for Process Development



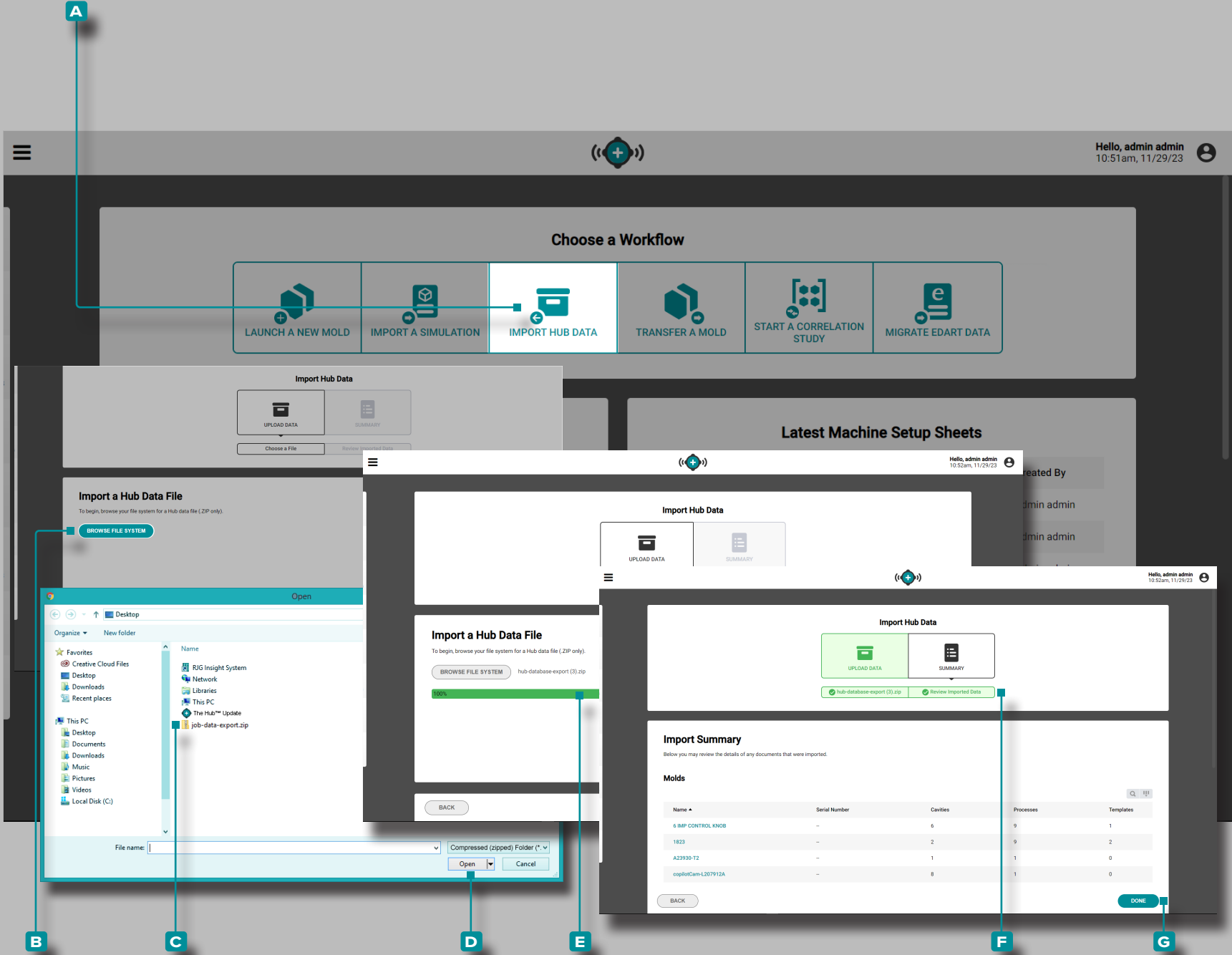
Edit a Material Record

Click the **A** material name to view the material record on the Materials records page. Click the **B** EDIT button to edit the material details.

Edit the material details, material properties, or material temperatures information.

Click the **C** SAVE button to save the material record, or the **D** CANCEL button to exit without saving the record.

The Hub for Process Development



Import Hub Data

The Import Hub Data tool allows the import of The Hub or job data from another The Hub software instance. Refer to "Data Import, Export, Backup, and Archival" on page 113 in the Appendix for complete information on imported and exported job data, and backup and archival of The Hub software.

Click the **A Import Hub Data** button on the Dashboard.

Click the **B BROWSE FILE SYSTEM** button to open the file browser, then locate and click the **C .zip file** to import, then click the **D Open** button.

If the data import is successful, a **E green status bar** will temporarily appear on the Import Job Data page. A **F Summary** of the data that was imported will then be displayed. Click the **F DONE** button to exit the import data function.

The Hub for Process Development

Start a Correlation Study

The Start a Correlation Study tool identifies correlations between physical part characteristics and process data by the comparison of part samples with completed CTQ measurements from the same mold to the process data gathered during sample taking.

NOTE Only part samples with CTQ measurements completed can be selected for use with the Start a Correlation Study tool.

Most physical characteristics of injection molded parts can be correlated to in-cavity variables displayed and recorded by the CoPilot system and The Hub software. Determining part-to-data correlations is accomplished by finding and changing cavity variables in order to change parts through planned experiments. Refer to "Finding Part Quality/Process Data Correlations with the CoPilot System and The Hub Software" on page 115 and "Choosing Alarm Settings with the CoPilot System and The Hub Software" on page 119 for more information on planning experiments and finding part correlations with the CoPilot system and The Hub software.

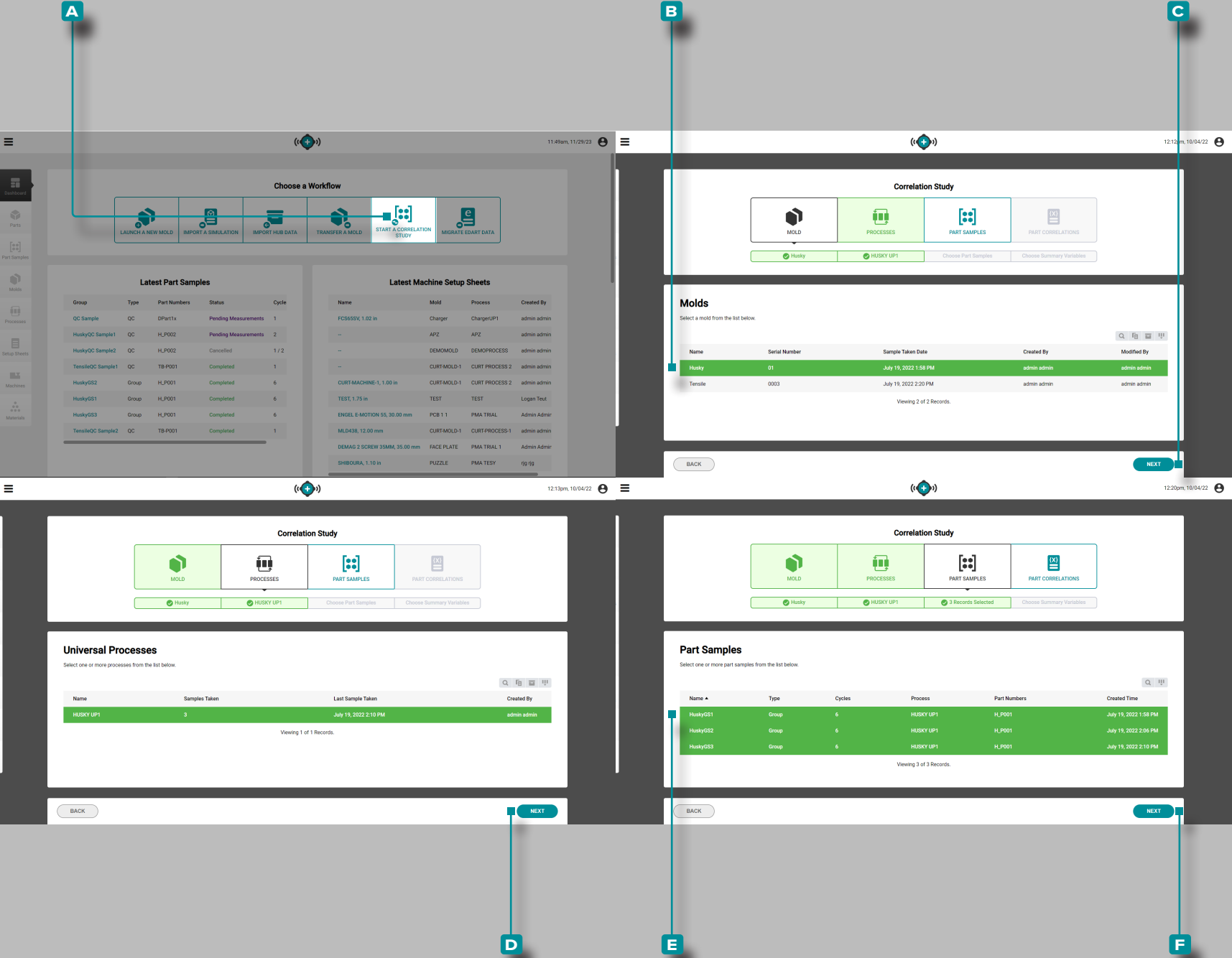
Click the **A Start a Correlation Study** button on the Dashboard.

Click to select the desired **B Mold** from the list of molds with associated, completed part samples. Click the **C NEXT** button to continue.

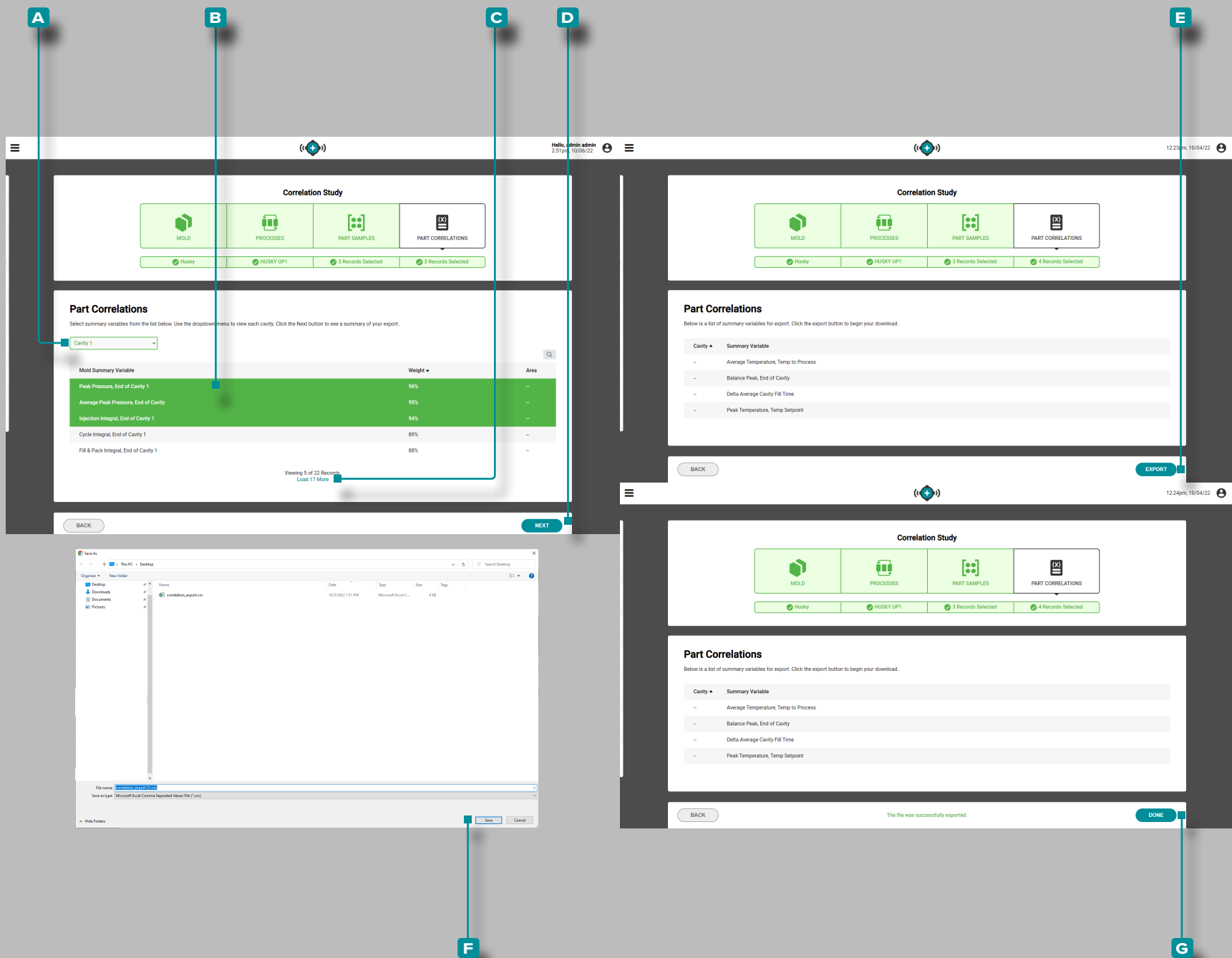
Once a mold is selected, the associated process will automatically be selected. Click the **D NEXT** button to continue.

Click to select the desired **E Part Sample(s)** from the list. Click the **F NEXT** button to continue.

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The Hub for Process Development





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Click  to select the desired **A Cavity location** from the drop-down list.

Click  to select the desired **B Mold Summary Variable(s)** from the list. **Variables with correlations $\geq 90\%$ show the highest correlation and are good choice for setting alarms.** If a correlation cannot be calculated (due to a sensor disconnection during sampling or other error), the variable correlation percent will be missing;  will be displayed instead. To expand the mold summary variable list, click  **C Load (x) More**.

 **CAUTION** RJG, Inc. does not recommend using Machine Summary Variables for correlation.

Click  the **D NEXT** button to continue.

Click  the **E EXPORT** button to create a downloadable .csv file. A file explorer window will open; select a name a location for the file, and then click  **F Save** to save the file.

Click  the **G DONE** button to exit.

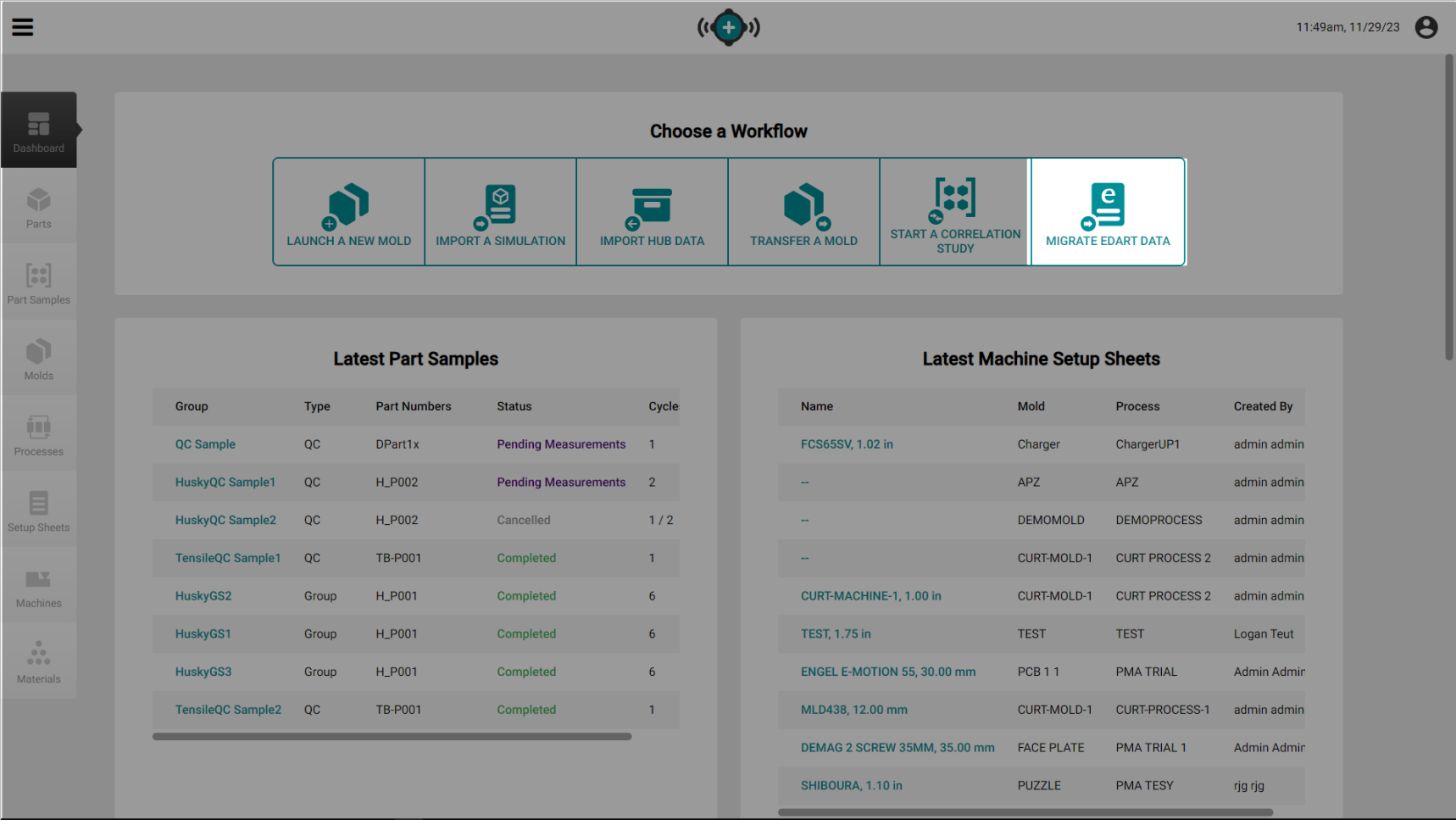
The Hub for Process Development

The .csv file contains the selected, exported mold summary variable data and the following columns:

- Timestamp
- Date and Time
- Mold Name
- Process Name
- Part Sample Name
- Sample Shot ID
- Part Sample Time
- Cycle Notes
- Part Sample Notes

From the exported mold summary variable correlation data, alarm settings can be made using the lowest and highest settings used during part sample testing. Refer to "Finding Part Quality/Process Data Correlations with the CoPilot System and The Hub Software" on page 115 and "Choosing Alarm Settings with the CoPilot System and The Hub Software" on page 119 for more information on planning experiments and finding part correlations with the CoPilot system and The Hub software.

The Hub for Process Development



Migrate eDART Data

The Migrate eDART Data feature enables users to convert and migrate the following:

- Mold Sensor Configurations,
- Process Templates, and
- Process Setups

from eDART systems to The Hub software, for use with the CoPilot systems.

The Migrate eDART Data feature *does not currently support* the conversion or migration of the following:

- Machine Configurations,
- Alarm Settings,
- V→P Settings, or
- Valve Gate Settings

from eDART systems to The Hub software/CoPilot system.

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The Hub for Process Development

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Get eDART Configuration Files

An eDART configuration file in .zip format is required to migrate data to The Hub system. There are two methods of retrieving eDART configurations files: through the eDART Data Manager (EDM), or through the eDART Data Extractor.

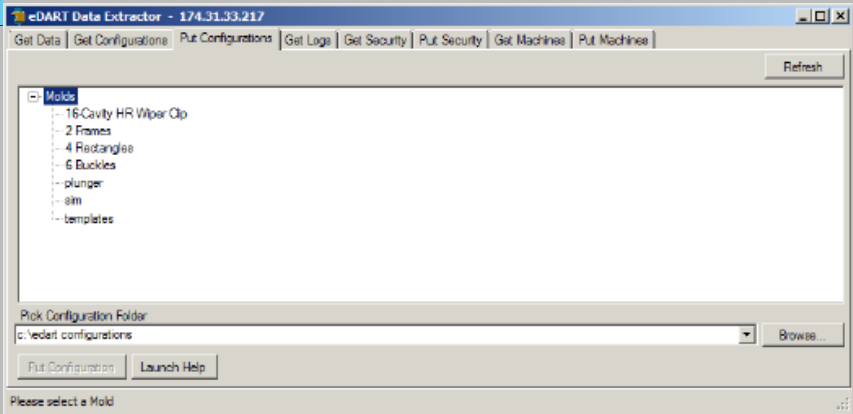
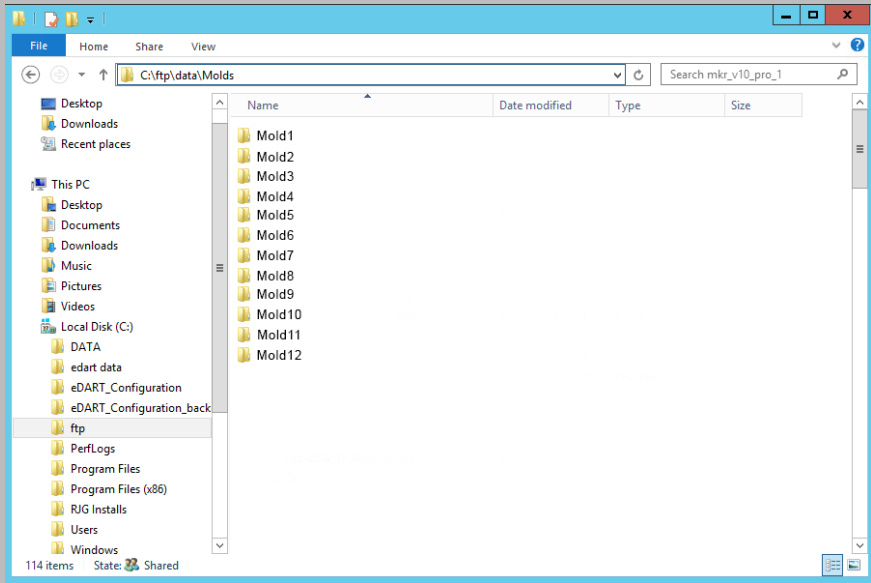
Extract Configuration Files from eDART Data Manager (EDM)

1. From a networked, connected computer, locate the eDART data folder.
c:\eDART_Configurations_Groups\Group Name\Molds
2. Locate the \Molds folder.
3. Copy the \Molds folder to desktop.
4. Compress the \Molds folder to a .zip file.
(Right click the folder, then click "Send to", and then click "Compressed (zipped) folder".)
5. File is ready for upload to The Hub Migrate eDART Data tool.

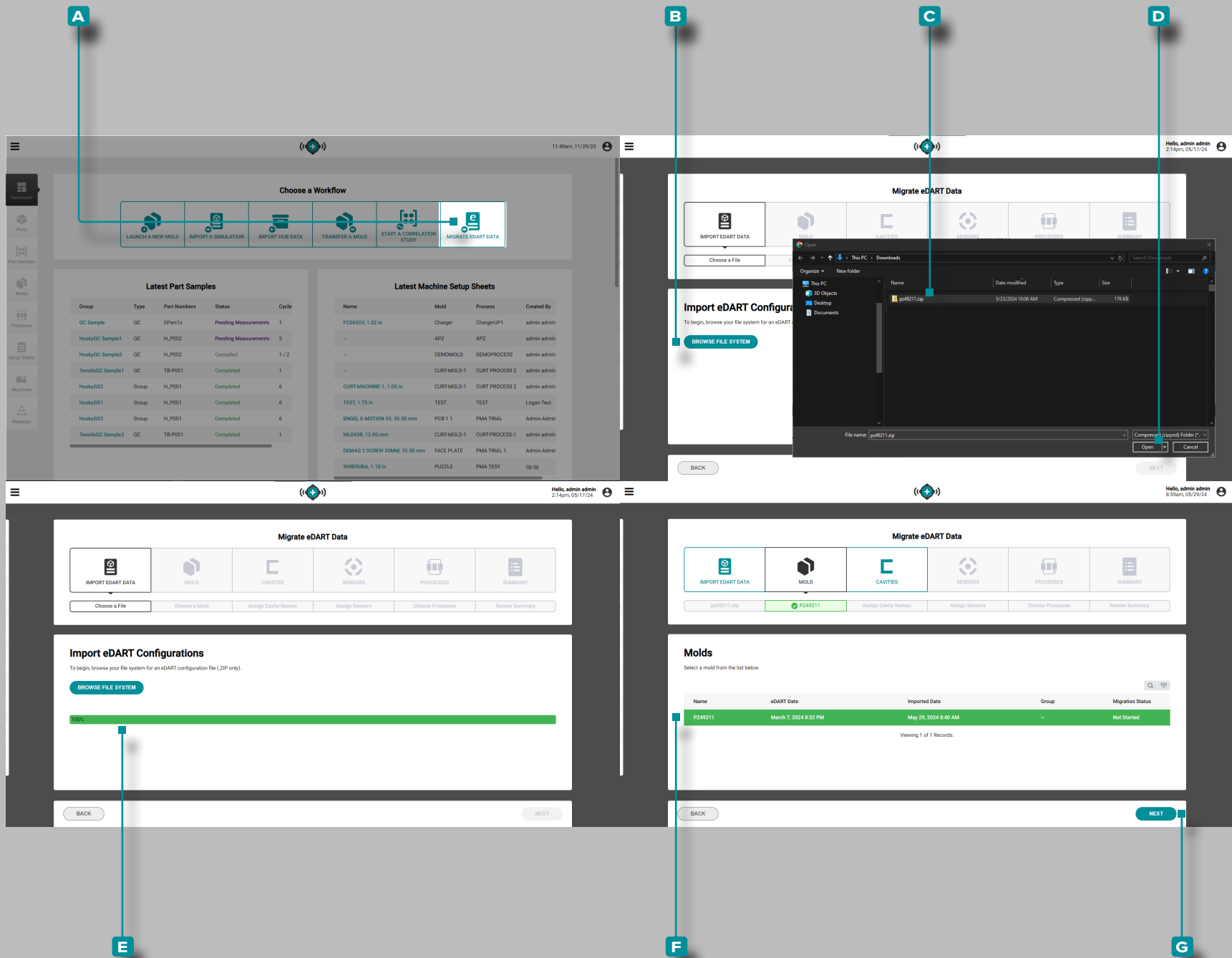
Extract Configuration Files from the eDART Data Extractor

1. From a networked, connected computer, open the eDART Data Extractor.
2. Select the Get Configurations tab.
3. Select a Mold.
4. Select a Save Folder.
5. Select Get Configuration.
6. Compress the folder to a .zip file.
(Right click the folder, then click "Send to", and then click "Compressed (zipped) folder".)
7. File is ready for upload to The Hub Migrate eDART Data tool.

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The Hub for Process Development



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Click the **A Migrate eDART Data** button from the Process Development Dashboard.

Import eDART Configurations

Click the **B Browse File System** button on the Migrate eDART Data, Import eDART Data page. Navigate to the desired **C eDART data .zip** file in the file explorer window, and **click** the **D Open** button.

NOTE The Hub software Migrate eDART Data feature accepts only eDART data files that are in .zip format.

A **E File Upload Progress Bar** will display file upload progress on the Migrate eDART Data, Import eDART Data page; once the file is uploaded, the Migrate eDART Data feature will automatically navigate to the next step: Molds.

Molds

Click a **F Mold** from the Mold list to select it for migration. Click the **G Next** button to continue migration of the selected mold.

(continued on next page)

The Hub for Process Development

Menu icon

Navigation icons

Hello, admin admin
8:56am, 05/29/24

Migrate eDART Data

IMPORT EDART DATA	MOLD	CAVITIES	SENSORS	PROCESSES	SUMMARY
pz49211.zip	✓ PZ49211	Assign Cavity Names	Assign Sensors	Choose Processes	Review Summary

Confirm Mold Settings: Step 1 of 2

Confirm mold name and assign the number of cavities that are on the mold.

Name* PZ49211

Cavities* 8

BACK

NEXT

(continued from previous page)

Confirm Mold Settings: Step 1 of 2

Optionally, click the **A** Name field to enter a mold name.

Click the **B** Cavities field to enter the number of cavities in the mold; the number of cavities in the mold is required. Click the **C** Next button to continue migration of the selected mold.

(continued on next page)

The Hub for Process Development

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Assign Cavity Names: Step 2 of 2

The eDART system provided sensor identifier fields, in which cavity names, cavity IDs, or other descriptions such as End-of-Cavity (eoc), Mid-Cavity(mid), or Post-Gate (pg) could be entered. The CoPilot system provides separate cavity name and cavity ID fields; use the provided eDART Identifiers as a reference while entering cavity names.

A list of cavities is populated; **click** ^A each **Cavity** field and **enter** ^B a cavity name for each name; **the cavity names are required**. **DO NOT** enter any sensor "idents" (identifiers) in the cavity name fields.

Click ^B the **Next** button to continue migration of the selected mold.

(continued on next page)

Migrate eDART Data

IMPORT EDART DATA | **MOLD** | CAVITIES | SENSORS | PROCESSES | SUMMARY

pz49211.zip | **PZ49211** | Assign Cavity Names | Assign Sensors | Choose Processes | Review Summary

Assign Cavity Names: Step 2 of 2

Rename your cavities if desired.

Cavity Names

Cavity 1:

Cavity 2:

Cavity 3:

Cavity 4:

Cavity 5:

Cavity 6:

Cavity 7:

Cavity 8:

eDART Identifiers

The eDART system provided sensor Ident (identifier) fields, in which users could enter cavity names, cavity IDs, or other descriptions. The CoPilot system provides separate cavity name and cavity ID fields.

To preserve the information entered into the eDART system you may refer to the Ident information listed below. Enter only the cavity name in the provided cavity names fields. DO NOT enter any additional identifiers in the cavity names fields—those will be entered during the next step.

eoc1	eoc2	eoc3	eoc4
mc1	mc2	pg1	pg2

BACK **NEXT**

The Hub for Process Development

(continued from previous page)

Choose Sensors: Step 1 of 2

A list of sensors is populated; the list includes the sensor serial number, model, Lynx [Adapter] Model, eDART Identifier, and Location. Click the **A Show/Hide Generic Adapters** button to show or hide any generic Lynx adapters.

Click anywhere on a **B sensor row** to select a sensor for migration; selected sensor rows will be highlighted green. Click the **C NEXT** button to continue migration.

Generic Adapters

Generic adapters are generally the adapter which is mounted outside the mold and connected to the sensors through the plate adapter located on the of the mold; for example, piezoelectric sensors are connected directly to the PZ-4 sensor plate, and the sensor plate is connected to the generic adapter PZ/LX4F-S-ID.

Both adapters will display sensor configurations, *however*, the plate adapter located on the mold will display the necessary mold-related sensors while the generic adapter may be used across multiple molds and show unnecessary configurations. Generic adapters are automatically hidden by default.

(continued on next page)

Migrate eDART Data

IMPORT EDART DATA | MOLD | CAVITIES | SENSORS | PROCESSES | SUMMARY

pz49211.zip | PZ49211 | 8 Total | Assign Sensors | Choose Processes | Review Summary

Choose Sensors: Step 1 of 2

Select which sensors you wish to migrate.

All generic adapters have been hidden for your convenience.

SHOW GENERIC ADAPTERS

Sensor	Model	Lynx Model	eDART Identifier	Location
1/1402500550	9211	PZ_4	eoc1	End of Cavity
2/1402500550	9211	PZ_4	eoc2	End of Cavity
3/1402500550	9211	PZ_4	pg1	Post Gate
4/1402500550	9211	PZ_4	pg2	Post Gate
1/1402500560	9211	PZ_4	eoc3	End of Cavity
2/1402500560	9211	PZ_4	eoc4	End of Cavity
3/1402500560	9211	PZ_4	mc1	Mid Cavity
4/1402500560	9211	PZ_4	mc2	Mid Cavity

BACK | NEXT

The Hub for Process Development

(continued from previous page)

Assign Sensors: Step 2 of 2

For each sensor, click the **A** Cavity dropdown to select and assign a cavity name for the sensor.

Optionally, enter the an **B** ID (sensor identifier); the eDART identifiers are listed for reference. Click the **C** Next button to continue to process migration.

Choose Processes: Step 1 of 2

Click anywhere on a **D** process row to select a process for migration; selected process rows will be highlighted green, or optionally, click the **E** select all button to select all available processes. Click the **F** NEXT button to continue migration.

Configure Processes: Step 2 of 2

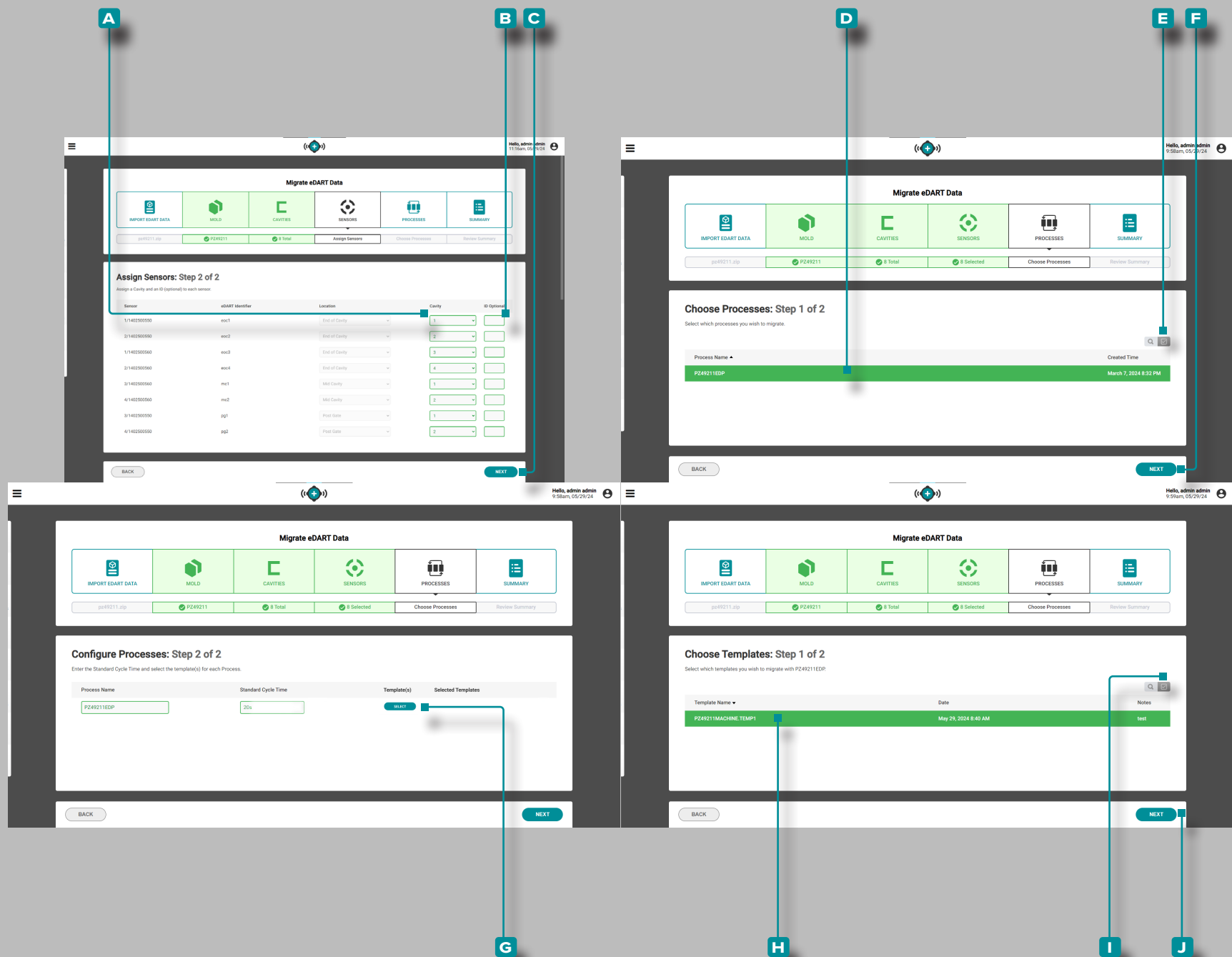
Optionally, enter a different process name or standard cycle time in the associated fields.

Choose Templates: Step 1 of 2

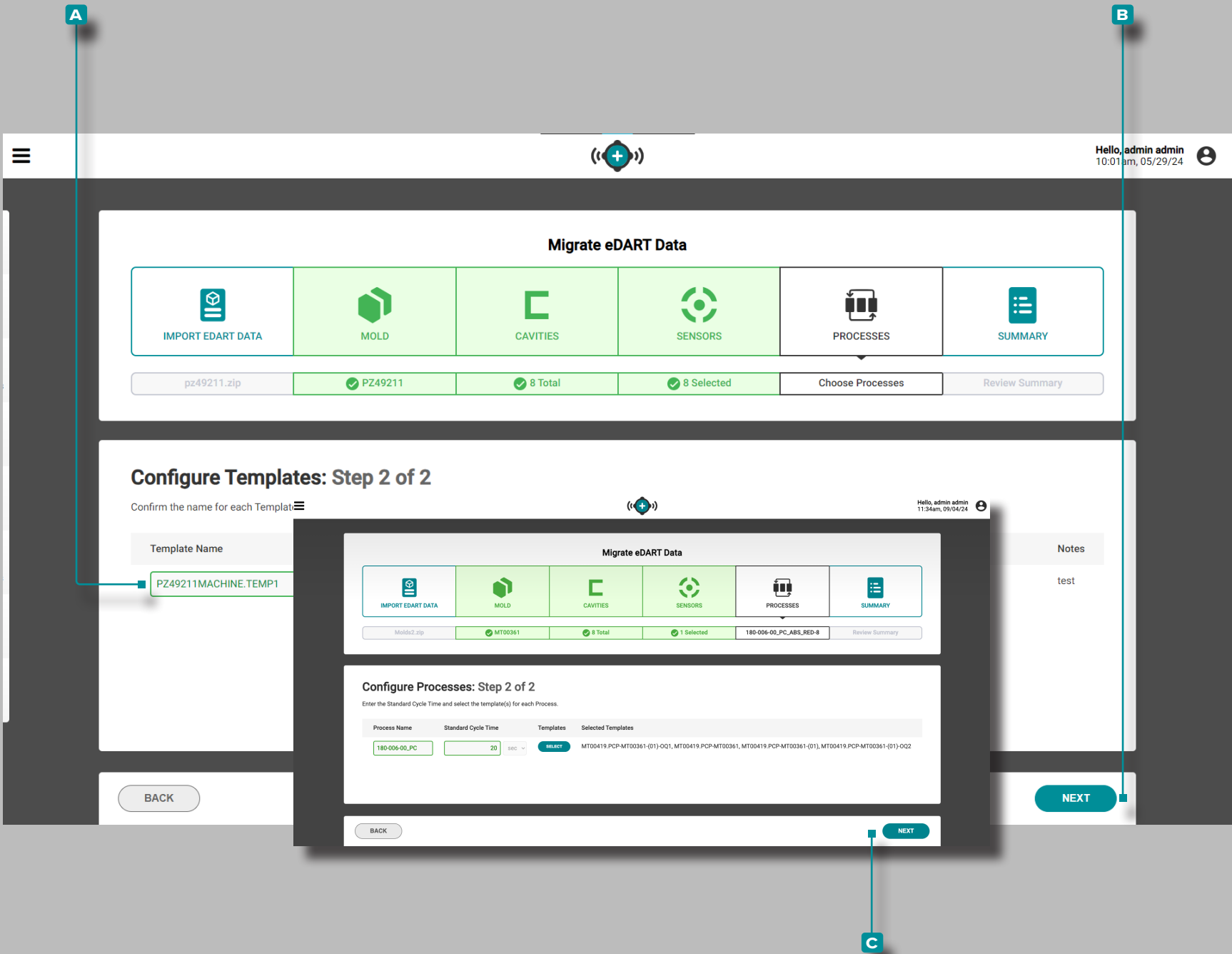
Click the **G** SELECT button to view and add process templates.

Click anywhere on a **H** template row to select a template for migration; selected template rows will be highlighted green, or optionally, click the **I** select all button to select all available templates. Click the **J** NEXT button to continue migration.

(continued on next page)



The Hub for Process Development



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Configure Templates: Step 2 of 2

Optionally, click **A** to enter a different **A** template name in the associated field. Click **B** the **B** NEXT button to add the template to the process.

Configure Processes: Step 2 of 2

Click **C** the **C** NEXT button to complete process migration.
(continued on next page)

The Hub for Process Development

IMPORT eDART DATA

MOLD

CAVITIES

SENSORS

PROCESSES

SUMMARY

pz49211.zip

PZ49211

8 Total

8 Selected

PZ49211EDP

Review Summary

Summary:

Review the migration summary.

Mold NamePZ49211

CAVITY NAMES

Cavity 11

Cavity 22

Cavity 33

Cavity 44

Cavity 55

Cavity 66

Cavity 77

Cavity 88

SENSORS

Name	Cavity	Location	ID	Model	Lynx Model	Pin Type	Pin Size	Sensitivity
1/1402500550	1	End of Cavity	eoc1	9211	PZ_4	Round	5 mm	4.5
2/1402500550	2	End of Cavity	eoc2	9211	PZ_4	Round	5 mm	4.5
3/1402500550	7	Post Gate	pg1	9211	PZ_4	Round	5 mm	4.5
4/1402500550	8	Post Gate	pg2	9211	PZ_4	Round	5 mm	4.5
1/1402500560	3	End of Cavity	eoc3	9211	PZ_4	Round	5 mm	4.5
2/1402500560	4	End of Cavity	eoc4	9211	PZ_4	Round	5 mm	4.5
3/1402500560	5	Mid Cavity	mc1	9211	PZ_4	Round	5 mm	4.5
4/1402500560	6	Mid Cavity	mc2	9211	PZ_4	Round	5 mm	4.5

PROCESSES

Name	Standard Cycle Time	Templates
PZ49211EDP	20 sec	PZ49211EDP

BACK

SAVE & VIEW RECORD

SAVE & MIGRATE MORE

(continued from previous page)

Summary

The Summary provides a review of the migrated eDART data including mold name, cavity names, sensors, processes, and templates.

Click the **A SAVE & VIEW RECORD** button to complete the migration process and edit the current record data,

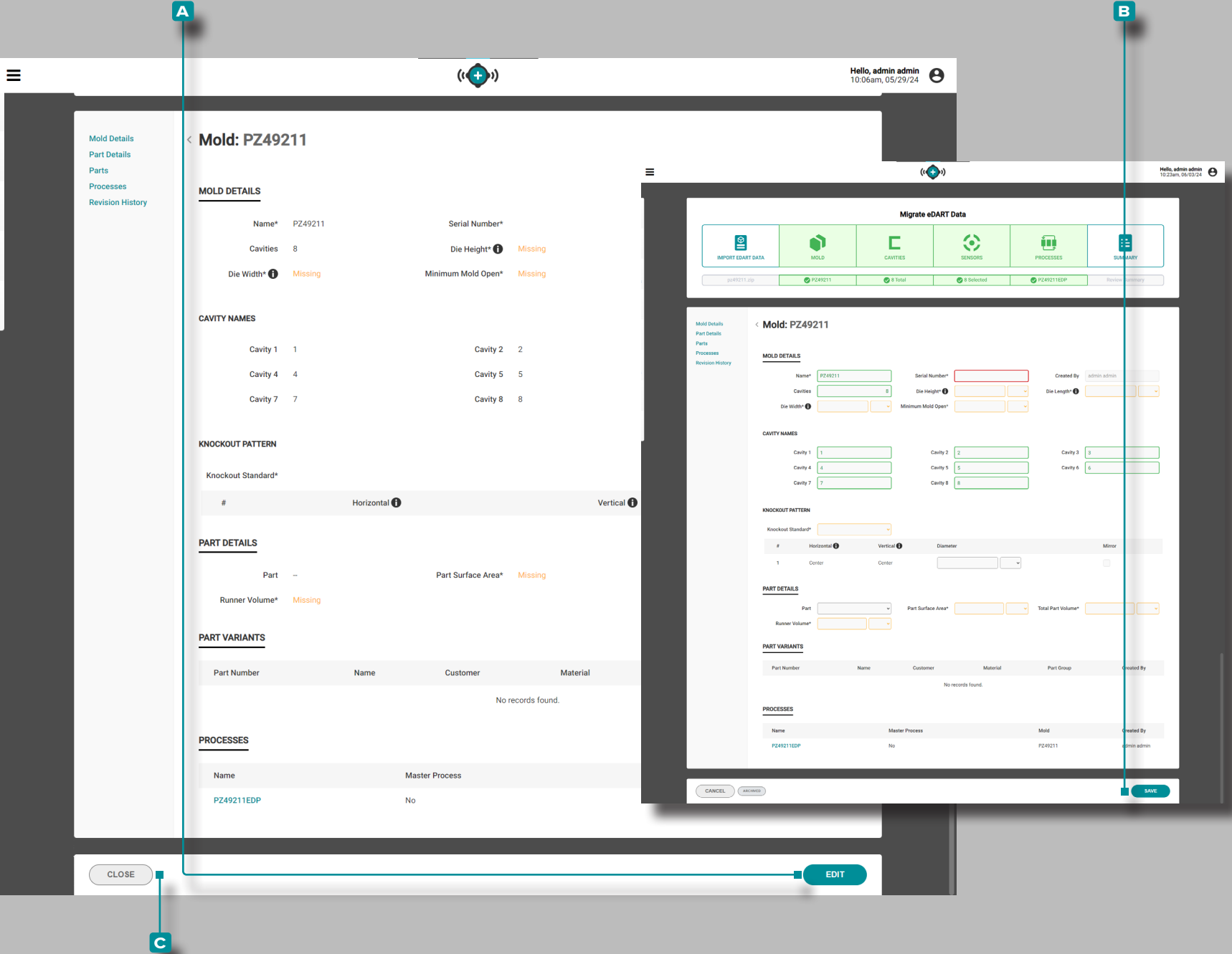
OR

click the **B SAVE & MIGRATE MORE** button to save the migrated data and continue migrating additional eDART system data.

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The Hub for Process Development



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Save and View Record

The migrated record view provides a review of the migrated eDART data including mold details, cavity names, knockout pattern, part details, part variants, and processes.

Click the **A** EDIT button to complete the record with any missing data. Once editing is complete, click the **B** SAVE button to save any changes. Click the **C** CLOSE button to close the record and return to the Migrate eDART Data workflow.

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The Hub for Process Development

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Viewing Migrated eDART Data on The Hub

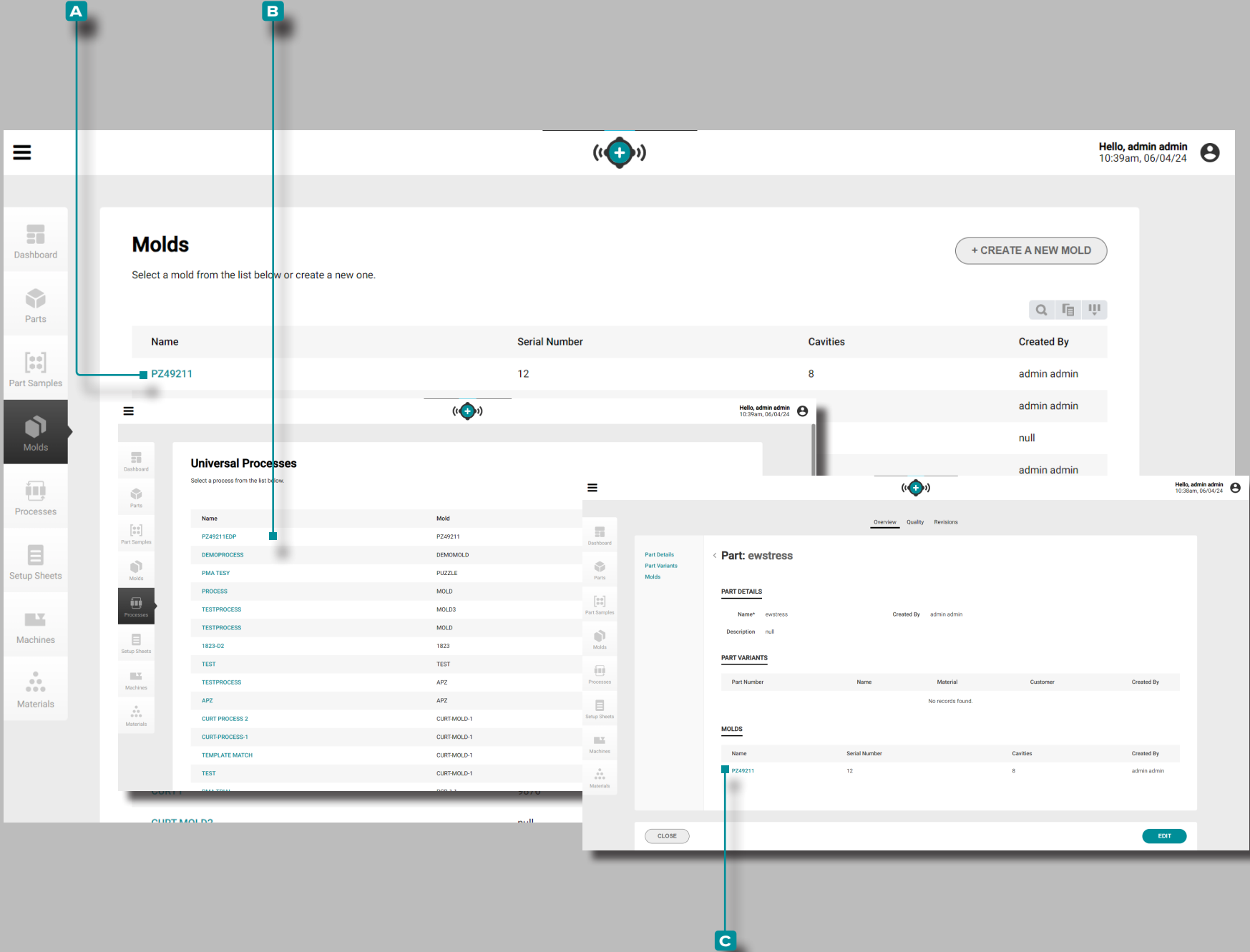
The migrated eDART data can be viewed on The Hub software for Process Development **A Molds** and **B Processes** views. The migrated mold is also displayed on any corresponding **C Parts** view.

Viewing Migrated eDART Data on the CoPilot System

The migrated eDART data Molds, Processes, and Parts can be selected for use in networked, connected CoPilot systems. When a migrated mold is selected in the CoPilot system, the associated, migrated process is also selected.

When the job is started, the user is able to load the process template from the Cycle Graph. With a process template and template summary variables selected the following can be viewed:

- imported template cycle curves can be displayed on the Cycle Graph.
- imported template summary data will be visible for all machine, mold, and composite variables when viewing the Previous Cycle Values widget.
- imported template summary data will be visible for all machine, mold, and composite variables when viewing the Alarm Settings widget.
- imported template summary data will be visible for all machine, mold, and composite variables when viewing the Template Match widget.



The Hub for Mold Transfer

Application Overview

The Hub for Mold Transfer, when licensed, is available on The Hub for Process Development dashboard.

The Hub for Mold Transfer generates part processes with machine-independent values and setup sheets with machine-dependent values for specific mold/machine/process combinations to launch new molds or transfer existing molds from the user-entered database of mold, machine, part, process, and material records.

Launch a New Mold

The Launch a New Mold tool generates a process with machine-independent values and a setup sheet for a job based on the selected part, part variant, mold, and machine.

NOTE Only part, mold, and machine records with the necessary, required fields completed can be selected for use with the Launch a New Mold tool due to mold/machine fitment requirements.

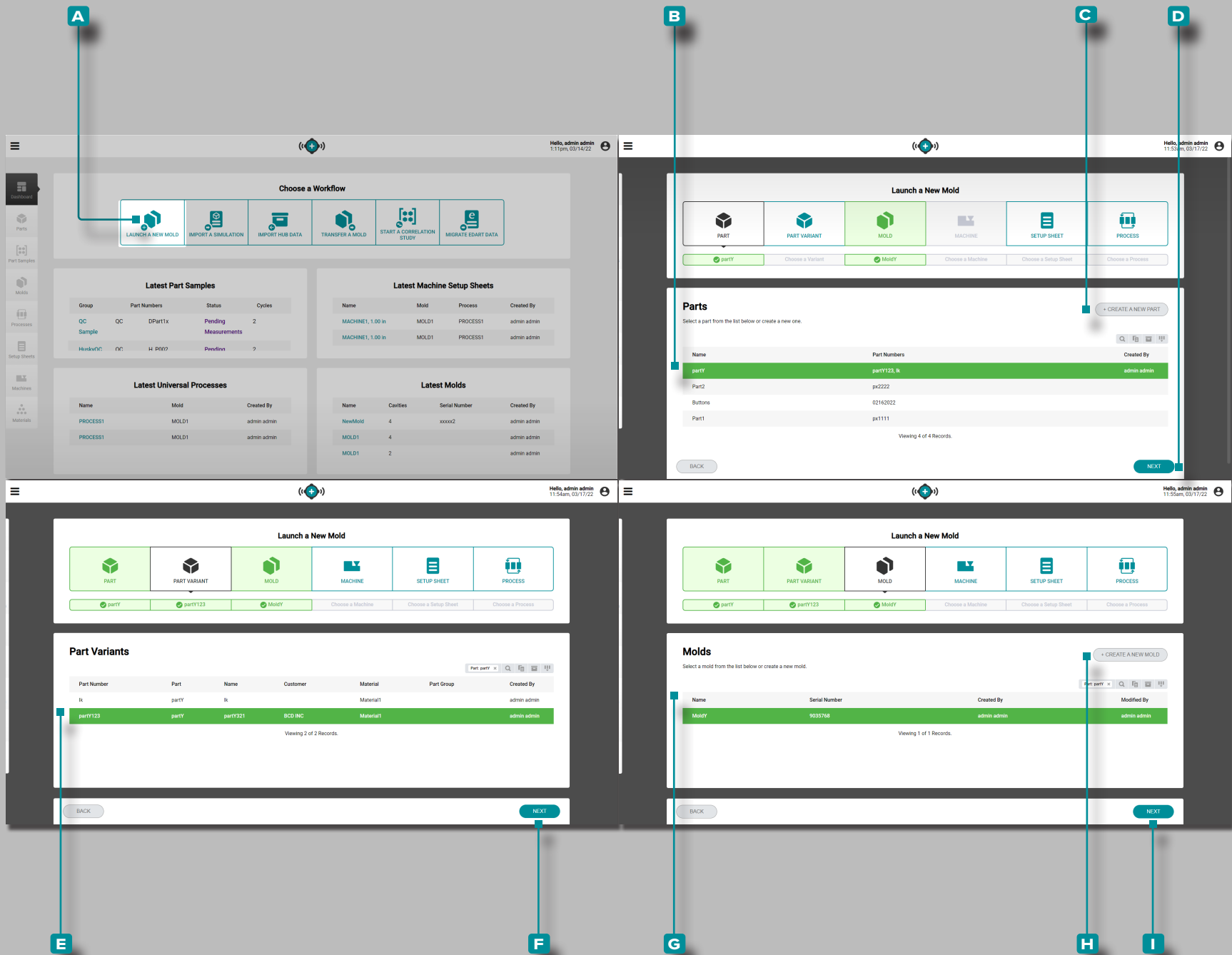
Click the **A Launch a New Mold** button on the Dashboard.

Click on a **B row** to select a part, or click the **C CREATE A NEW PART BUTTON**, then click the **D NEXT** button. If a new part was created, at least one part variant must also have been created in order to continue.

Depending upon the selected part and the part associations, the part variant and/or the mold may automatically be assigned. If the part variant or mold are not assigned, click to select the correct **E part variant**, then click the **F NEXT** button; click to select the correct **G mold** then click the **H NEXT** button.


If a new part and part variant(s) was created, click the **I CREATE A NEW MOLD** button, and create a new mold record to continue.

(continued on next page)




The Hub for Mold Transfer


(continued from previous page)

Click  on a **A** row to select a compatible machine. Machine compatibility is shown using the following colors:

- green indicates that one or more of a machine's capabilities is compatible and can provide the necessary process requirements;
- yellow indicates that one or more of a machine's capabilities may not be compatible with the current process requirements;
- red indicates that one or more of a machine's capabilities are not capable of providing the necessary process requirements.

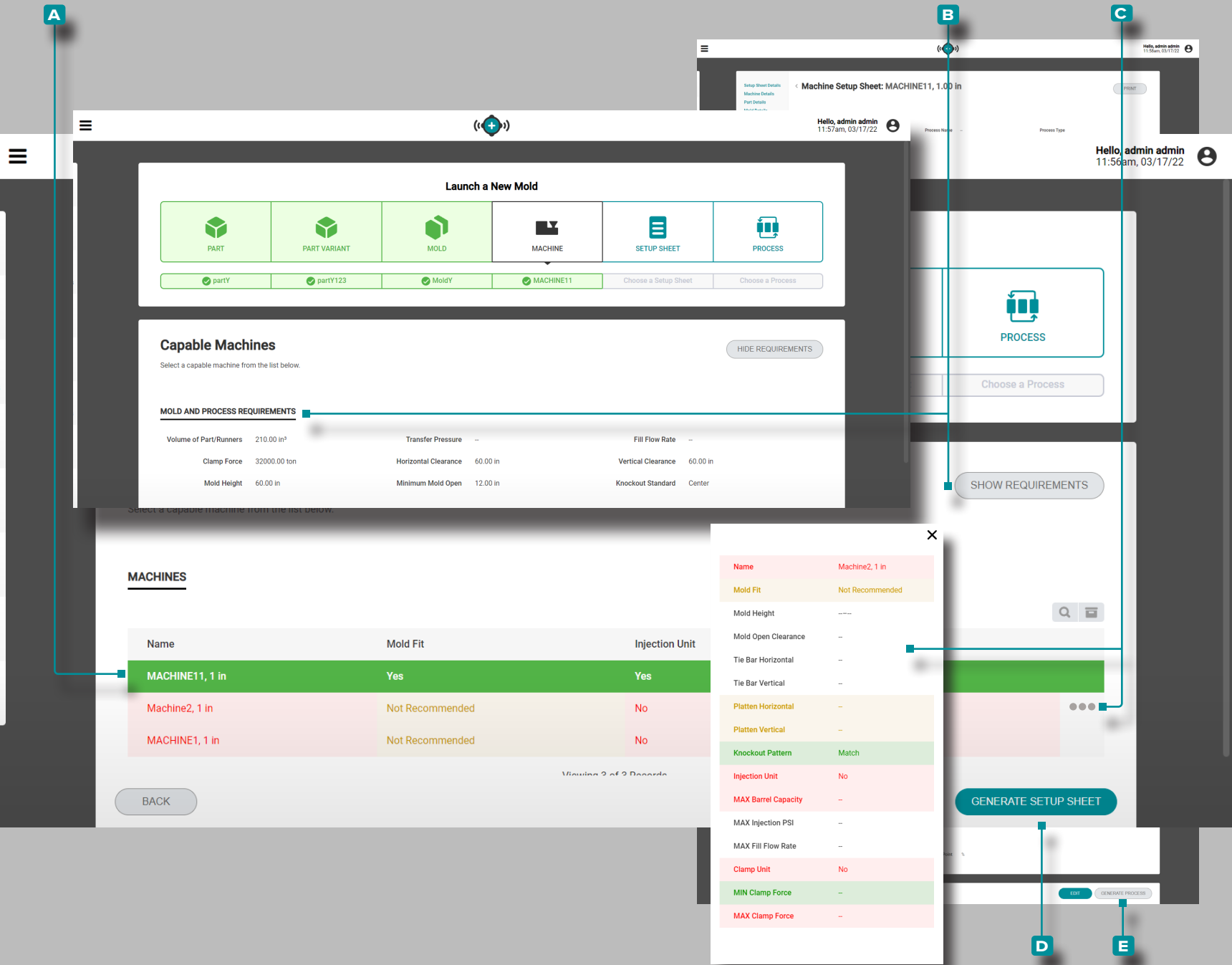
Refer to the Appendix section "Mold Launch, Mold Transfer, and Simulation Support Machine Compatibility" on page 110 for complete information on machine compatibility requirements.

Optionally, click  the **B** SHOW/HIDE REQUIREMENTS button to view/hide mold and process requirements to compare them with listed machines.

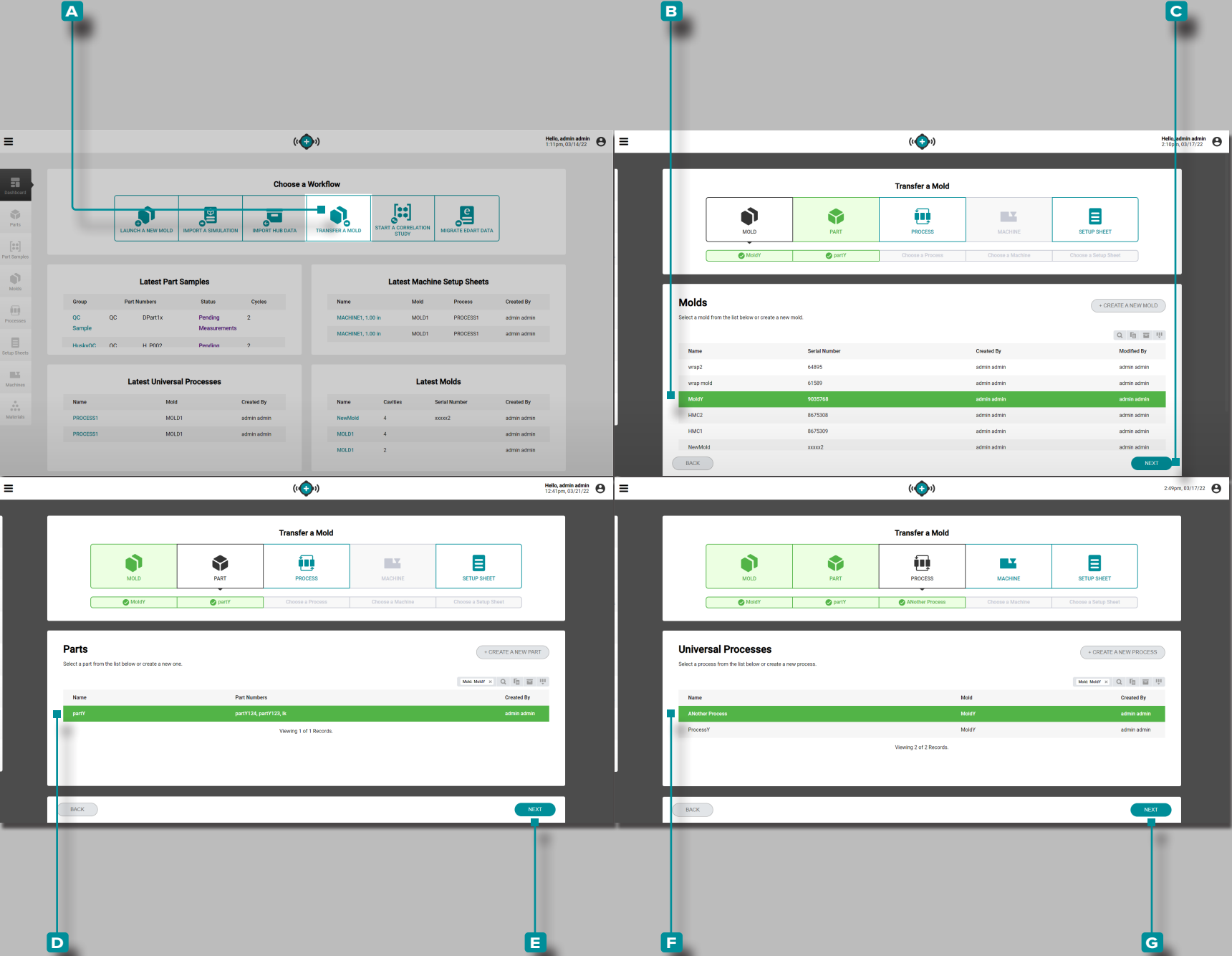
Optionally, hover over the right-hand side of a machine row, then click  on the **C** information icon to view complete machine information.

Click  the **D** GENERATE SETUP SHEET button to generate a setup sheet.

Click  the **E** GENERATE PROCESS button on the setup sheet to generate a process.



The Hub for Mold Transfer



Transfer a Mold

The Transfer a Mold tool generates a setup sheet of machine-dependent values for a job based on the selected part, mold, process, and machine.

NOTE Only part, mold, process, and machine records with the necessary, required fields completed can be selected for use with the Transfer a Mold tool due to mold/machine fitment requirements.

Click the **A** Transfer a Mold button on the Dashboard.

Click on a **B** row to select a mold, then click the **C** NEXT button.


If the selected mold has an existing part record associated, the part will be automatically selected, otherwise click on a **D** row to select a part, then click the **E** NEXT button.

Click on a **F** row to select a process (of machine-independent values), then click the **G** NEXT button.

(continued on next page)


The Hub for Mold Transfer


(continued from previous page)

Click  on a **A** row to select a compatible machine. Machine compatibility is shown using the following colors:

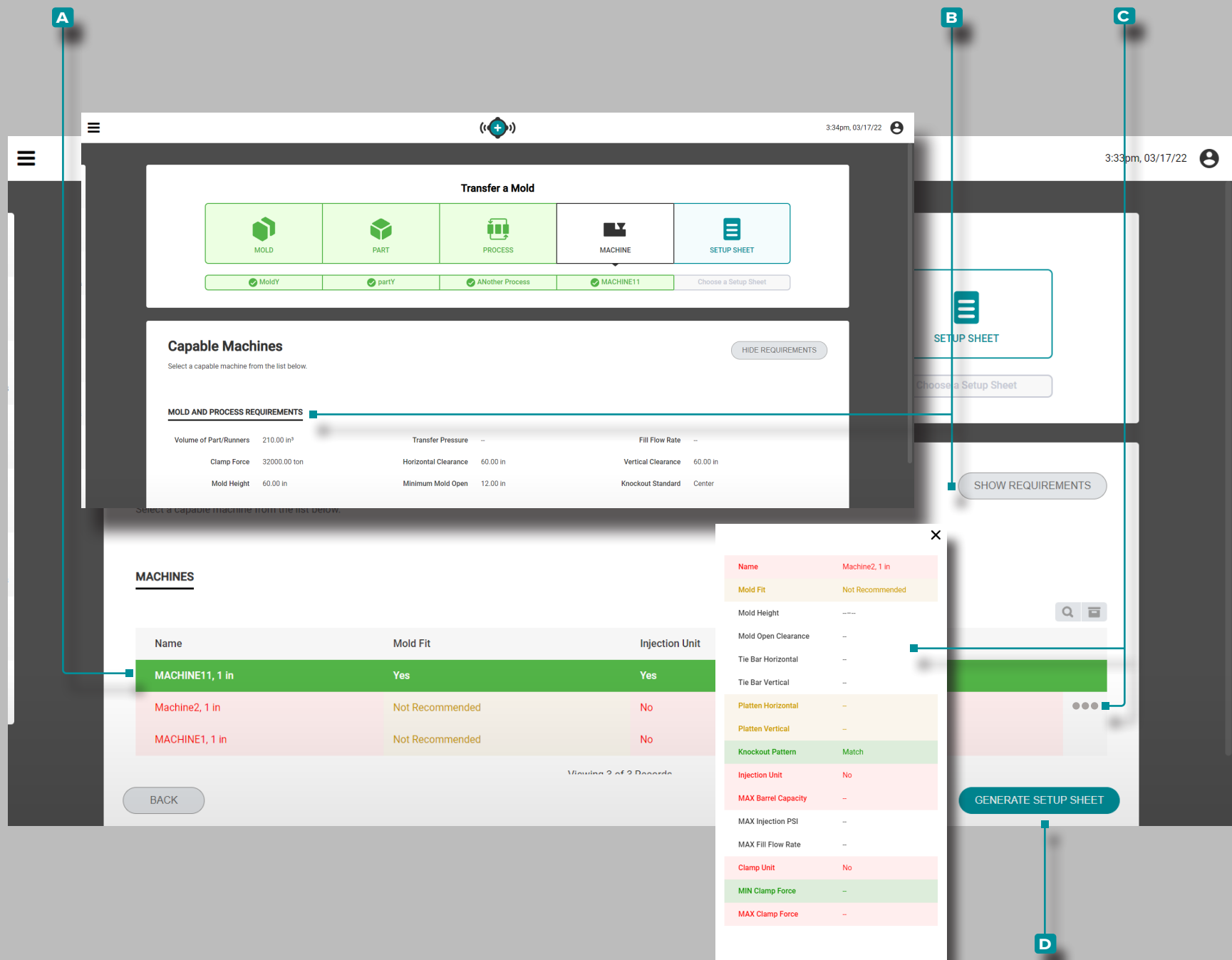
- green indicates that one or more of a machine's capabilities is compatible and can provide the necessary process requirements;
- yellow indicates that one or more of a machine's capabilities may not be compatible with the current process requirements;
- red indicates that one or more of a machine's capabilities are not capable of providing the necessary process requirements.

Refer to the Appendix section "Mold Launch, Mold Transfer, and Simulation Support Machine Compatibility" on page 110 for complete information on machine compatibility requirements.

Optionally, click  the **B** SHOW/HIDE REQUIREMENTS button to view/hide mold and process requirements to compare them with listed machines.

Optionally, hover over the right-hand side of a machine row, then click  on the **C** information icon to view complete machine information.

Click  the **D** GENERATE SETUP SHEET button to generate a setup sheet.



The Hub for Simulation Support

Application Overview

The Hub for Simulation Support, when licensed, is available on The Hub for Process Development dashboard. The Hub for Simulation Import allows mold flow simulation files to be uploaded to The Hub software.

Import a Simulation

The Import a Simulation tool generates a setup sheet of machine-dependent values for a job based on the imported simulation file (Moldex3D files only) and selected part, mold, process, and machine.

Click the **A Import a Simulation** button on the Dashboard.

Click the **B BROWSE FILE SYSTEM** button, select the simulation file (.zip) from the window, then click the **C Open** button. The simulation file will be uploaded; click the **D NEXT** button to continue.

Click on a **E row** to select a part, or create a new part, then click the **F NEXT** button.

Click on a **G row** to select a mold, complete the required mold fields, or create a new mold, then click the **H NEXT** button.

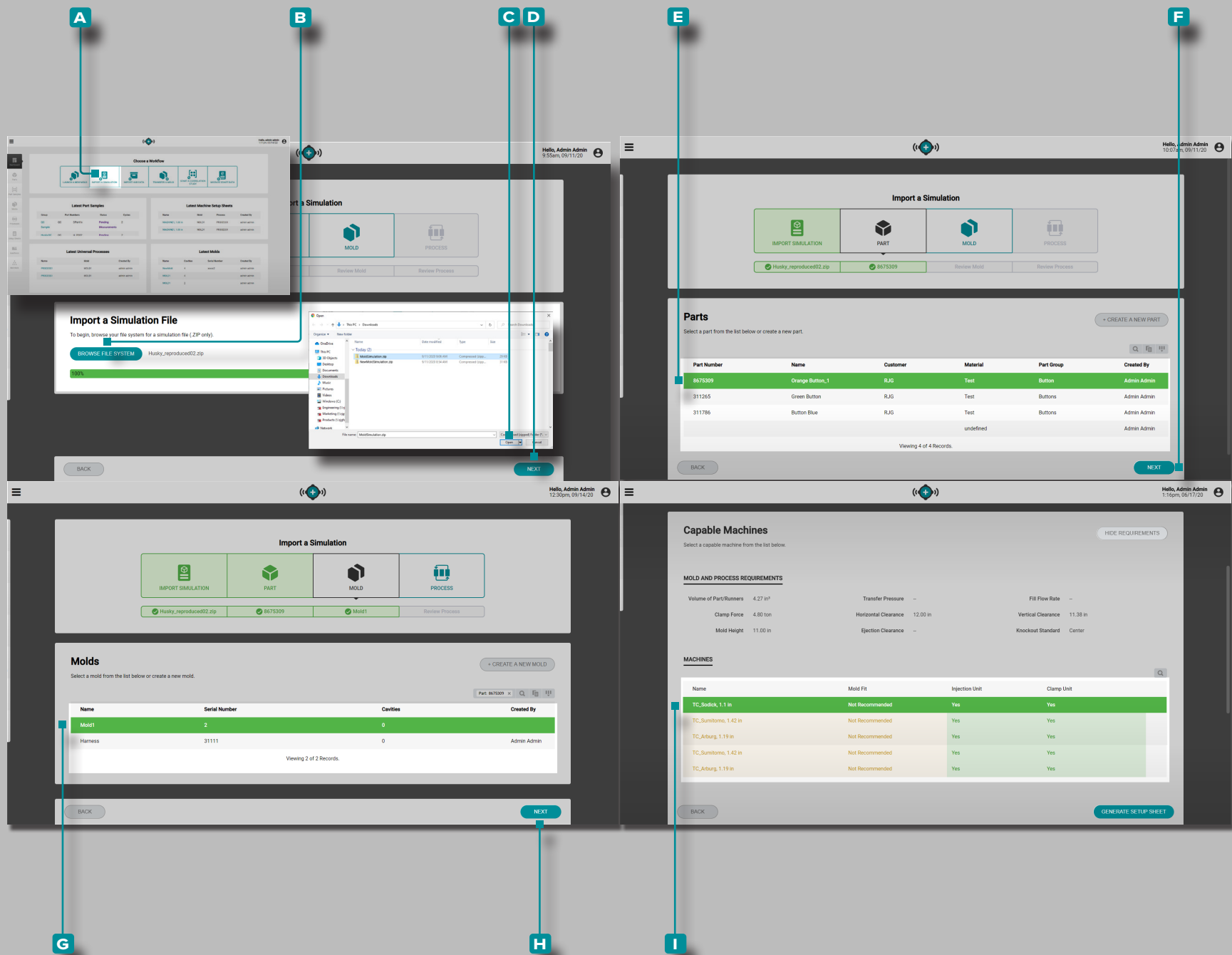
Select a process setup or complete the process setup and then click the **L NEXT/SAVE** button.

Click on a **I row** to select a compatible machine. Machine compatibility is shown using the following colors:

- green indicates that one or more of a machine's capabilities is compatible and can provide the necessary process requirements;
- yellow indicates that one or more of a machine's capabilities may not be compatible with the current process requirements;
- red indicates that one or more of a machine's capabilities are not capable of providing the necessary process requirements.

Refer to the Appendix section "Mold Launch, Mold Transfer, and Simulation Support Machine Compatibility" on page 110 for complete information on machine compatibility requirements.

(continued on next page)



The Hub for Simulation Support

The screenshot shows the 'Capable Machines' interface. Callout A points to the information icon in the machine list. Callout B points to the 'HIDE REQUIREMENTS' button. Callout C points to the 'GENERATE SETUP SHEET' button. Callout D points to the 'SAVE' button in the bottom right corner.

Capable Machines
Select a capable machine from the list below.

MOLD AND PROCESS REQUIREMENTS

Volume of Part/Runners	4.27 in³	Transfer Pressure	--	Fill Flow Rate	--
Clamp Force	4.80 ton	Horizontal Clearance	12.00 in	Vertical Clearance	11.38 in
Mold Height	11.00 in	Ejection Clearance	--	Knockout Standard	Center

MACHINES

Name	Mold Fit	Injection Unit	Clamp Unit
TC_Sodick, 1.1 in	Not Recommended	Yes	Yes
TC_Sumitomo, 1.42 in	Not Recommended	Yes	Yes
TC_Arburg, 1.19 in	Not Recommended	Yes	Yes
TC_Sumitomo, 1.42 in	Not Recommended	Yes	Yes
TC_Arburg, 1.19 in	Not Recommended	Yes	Yes

Machine Information Panel (Right):

Name	TC_Sodick, 1.1 in
Mold Fit	Not Recommended
Mold Height	9.84 in--
Mold Open Clearance	31.49 in
Tie Bar Horizontal	18.00 in
Tie Bar Vertical	16.50 in
Platten Horizontal	--
Platten Vertical	--
Knockout Pattern	--
Injection Unit	Yes
MAX Barrel Capacity	5.05 in³
MAX Injection PSI	751853 psi
MAX Fill Flow Rate	18.72 in³/sec
Clamp Unit	Yes
MIN Clamp Force	0.00 ton
MAX Clamp Force	110.00 ton

(continued from previous page)

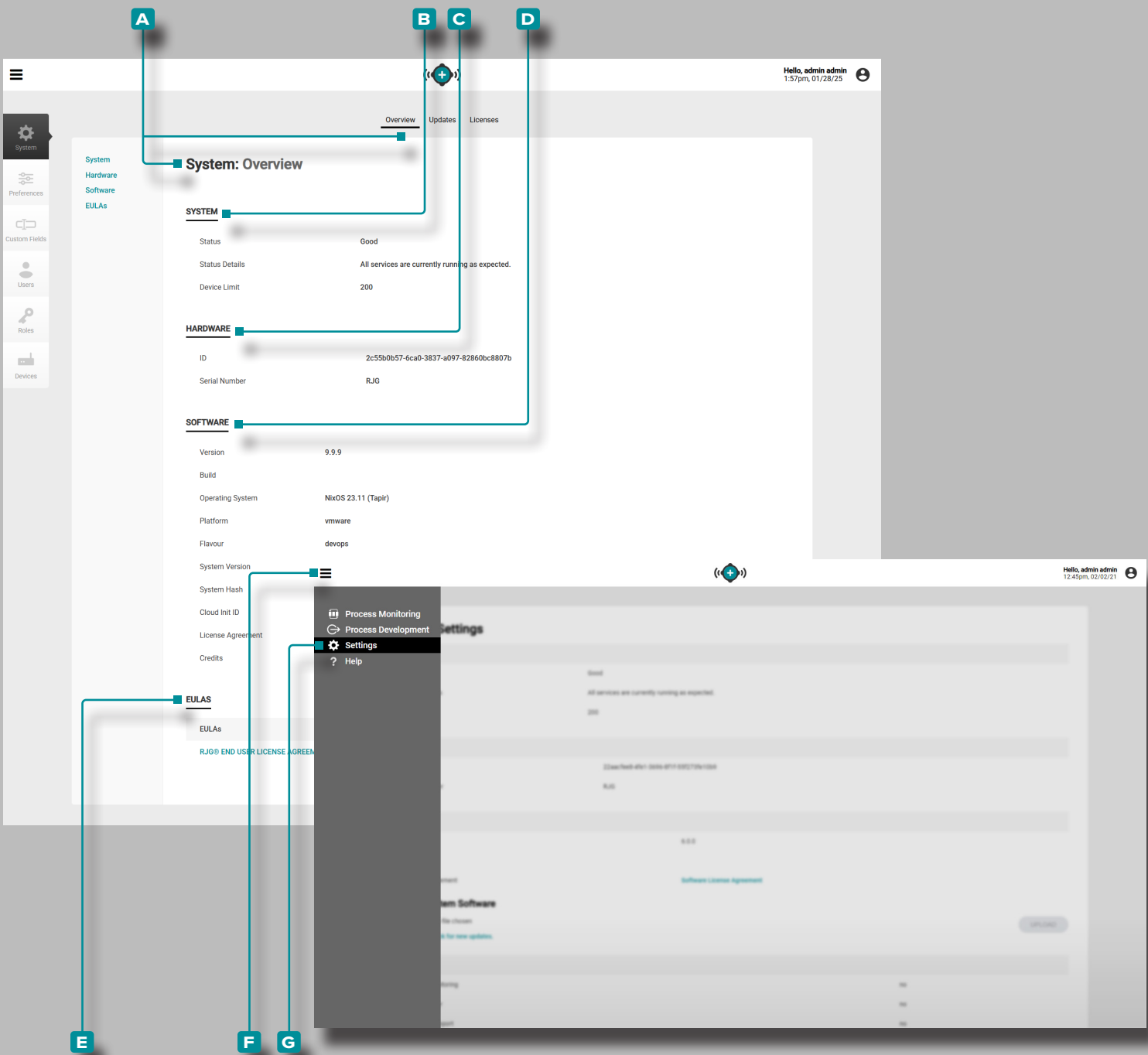
Optionally, hover over the right-hand side of a machine row, then **click** on the **A** information icon to view complete machine information, **AND/OR**

Click the **B** **SHOW/HIDE REQUIREMENTS** button to view/hide mold and process requirements to compare them with listed machines.

Click the **C** **GENERATE SETUP SHEET** button to generate a setup sheet.

Click the **D** **SAVE** button to save the setup sheet.

Settings



System Settings: Overview

The Hub **A** [System Settings: Overview](#) includes **B** [System](#), **C** [Hardware](#), **D** [Software](#), and **E** [End User License Agreement \(EULA\)](#) information.

Click **F** the [menu](#) icon from any page, then click **G** [Settings](#) to access overview, updates, and licenses information.

System

The System Settings **B** [System](#) information provides the system status, status details, and device limit.

Hardware

The System Settings **C** [Hardware](#) information provides the hardware identification code and serial number.

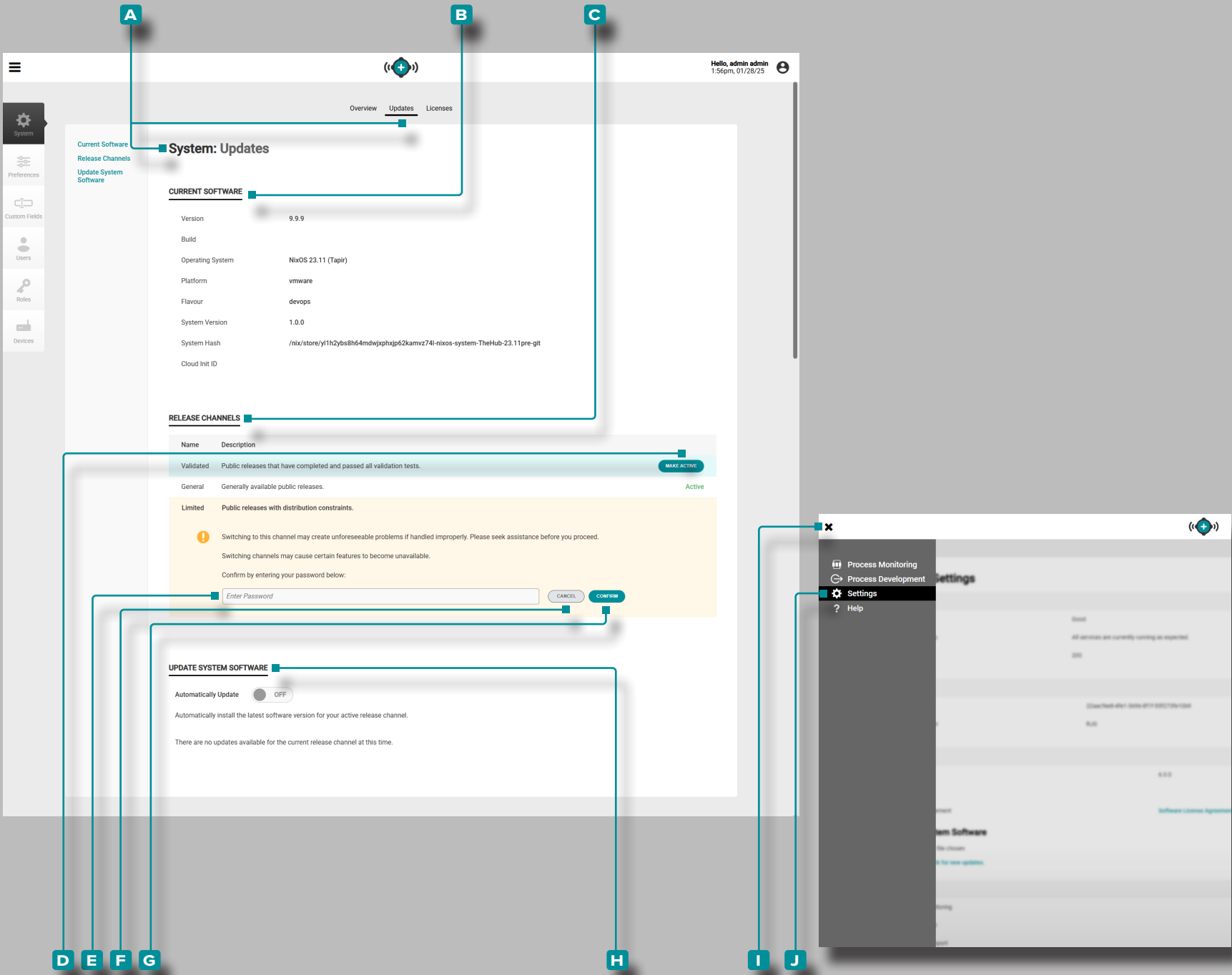
Software

The System Settings **D** [Software](#) information includes version number, build number, operating system (Debian or NixOS), platform, system hash, cloud init ID (if NixOS), software license agreement, and credits (open source licenses).

End User License Agreements (EULAs)

The **E** [EULA](#) information provides a PDF of the RJG® End User License Agreement for The Hub® software..

Settings (continued)



System Settings: Updates

The Hub **A** [System Settings: Updates](#) includes **B** [Current Software](#), **C** [Release Channels](#) (NixOS systems only), and **H** [Update System Software](#). Click ^{*} the **I** [menu](#) icon from any page, then click ^{*} **J** [Settings](#) to access **A** [System Settings: Updates](#) information.

Current Software

The Updates **B** [Current Software](#) information provides the version, build, operating system (Debian or NixOS), platform, flavor, system version, system health, and cloud init ID (if running a NixOS system).
(continued on next page)

Settings (continued)

System Settings: Updates (continued from previous page)

Release Channels (NixOS Systems Only)

The Updates **C** Release Channels—only visible if running a NixOS system—provides the user selection of Limited, General, or Validated releases. Click **I** the **1** menu icon from any page, then click **J** Settings to access **H** Update System Software information and **C** Release Channels.

Limited Release

A Limited release has passed all testing, but contains a breaking change (a change that may cause other parts to fail) that must be managed carefully.

General Release

A General release is a typical release, available to the general public.

Validated Release

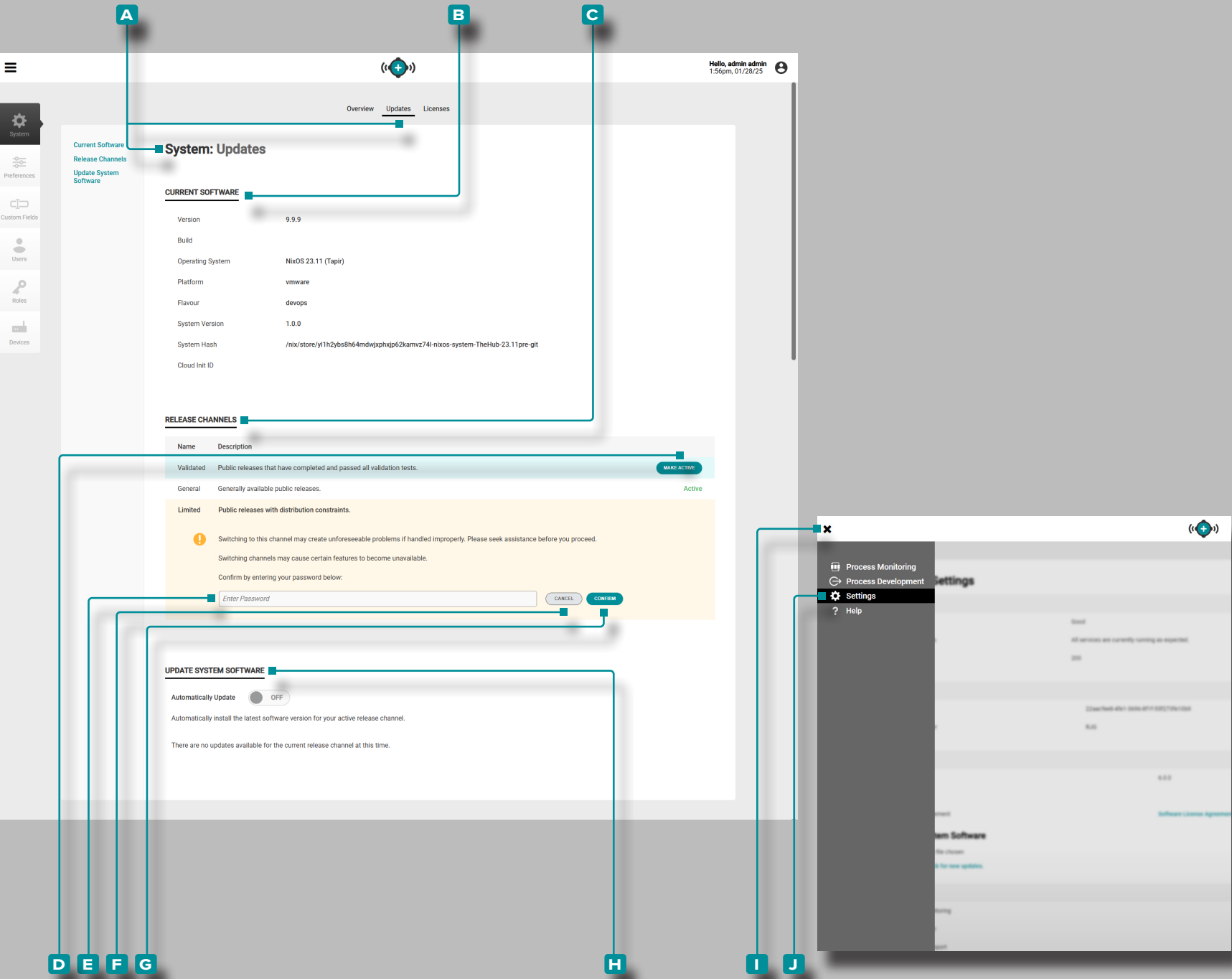
A Validated release is a release that has been tested and completed medical validation.

The currently-selected release channel will be designated by an "Active" marking within the release channel's table row. To select a different release channel, hover over the desired release channel row, then click **K** the **D** Make Active button.

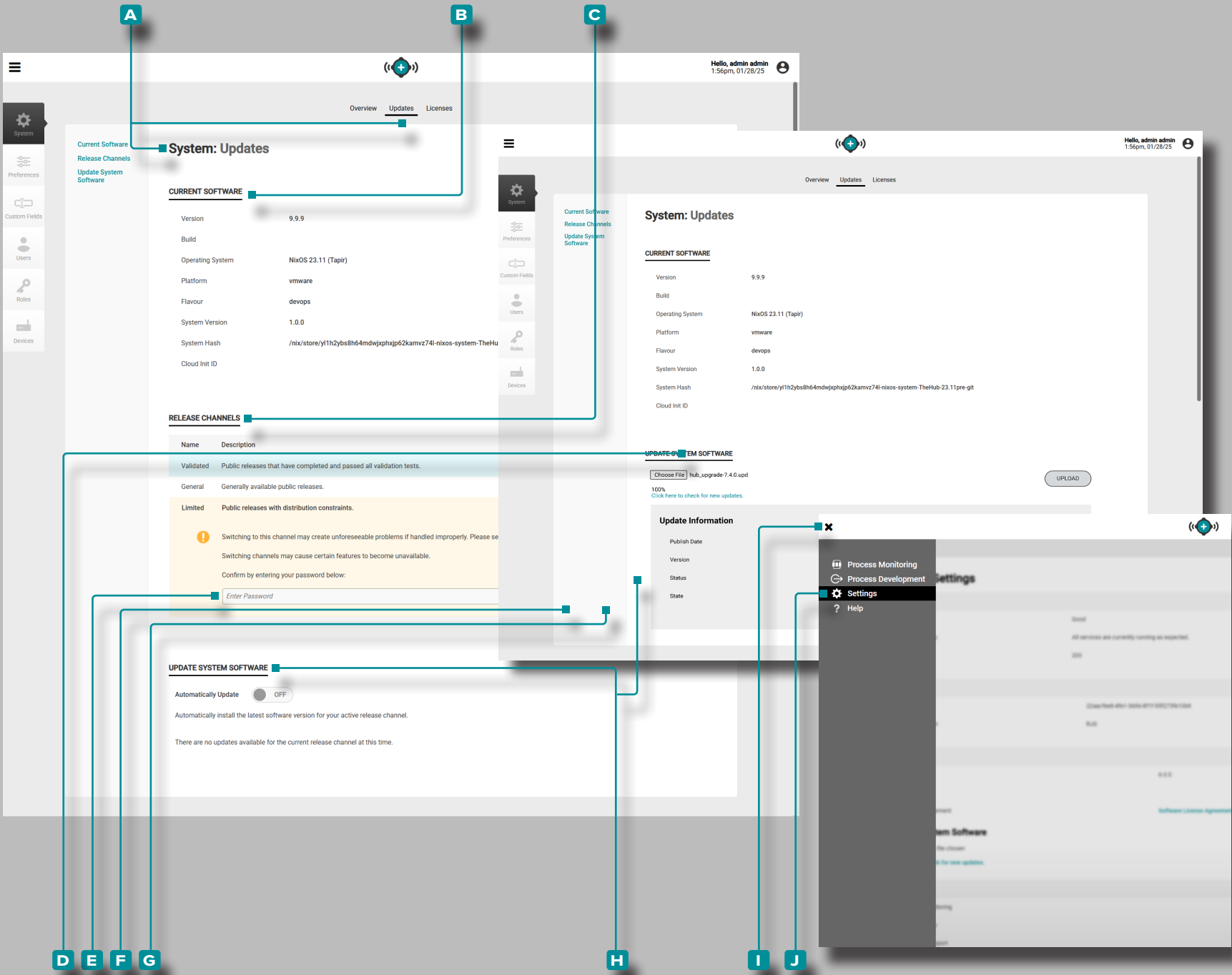
⚡ CAUTION Switching to a limited release channel may create unforeseeable problems; request assistance before proceeding. Switching to a different release channel may cause certain features to become unavailable.

Click **K** the **E** password field to enter **L** the password assigned to the user account, then click **G** CONFIRM button to confirm the change, or click the **F** CANCEL button to discard any changes.

(continued on next page)



Settings (continued)



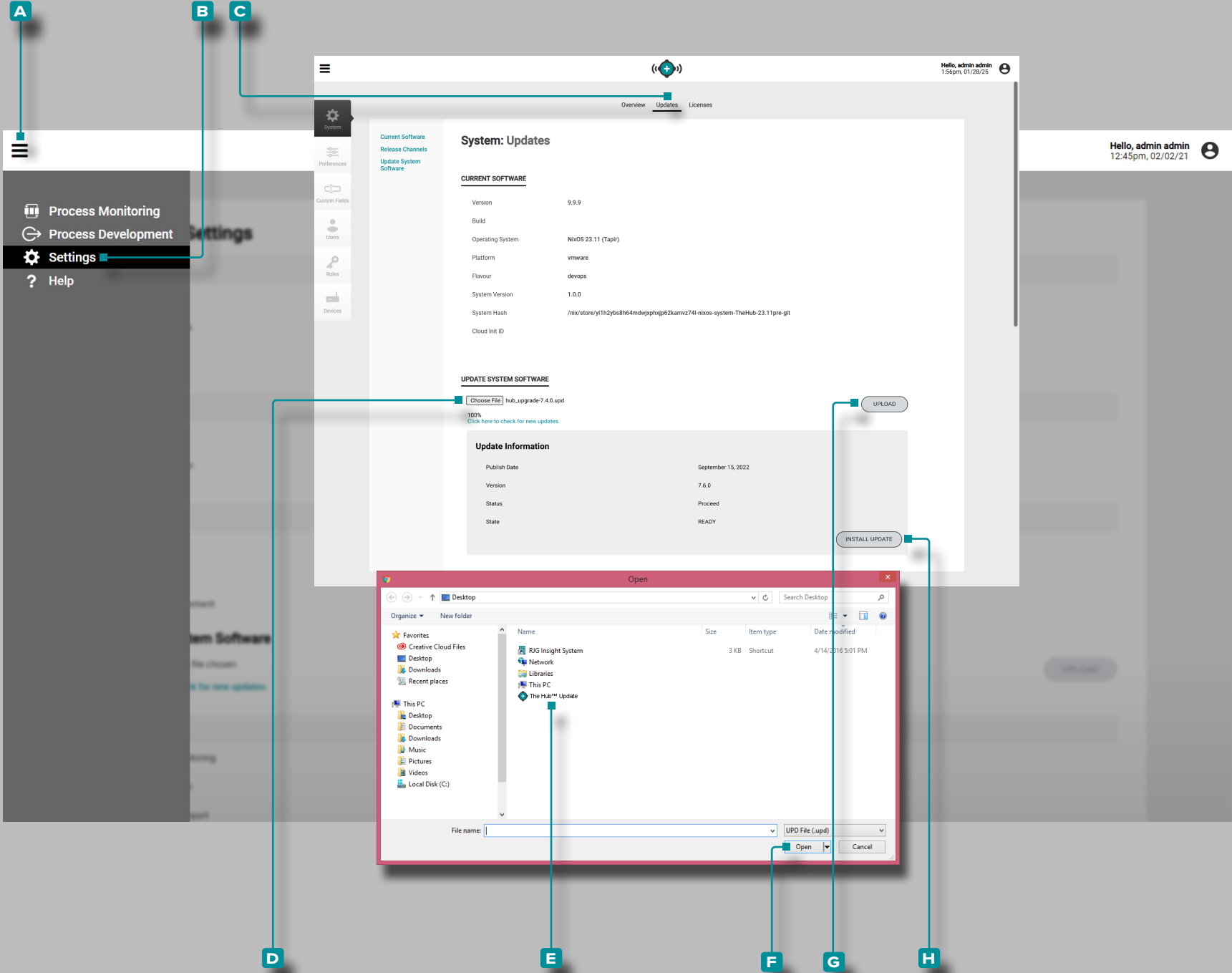
System Settings: Updates (continued from previous page)

Update System Software

The System Settings **H Update System Software** provides the software update functions for Debian and NixOS system users. **Click** the **I menu** icon from any page, then **click** **J Settings** to access **H Update System Software** information.

Refer to "Updating a Debian System" on page 92 or "Updating a NixOS System" on page 93 for Debian and NixOS system updates.

Settings (continued)



Updating a Debian System

A Debian system The Hub software can be updated directly from System Settings. Update The Hub software as necessary for the latest bug fixes and new features.

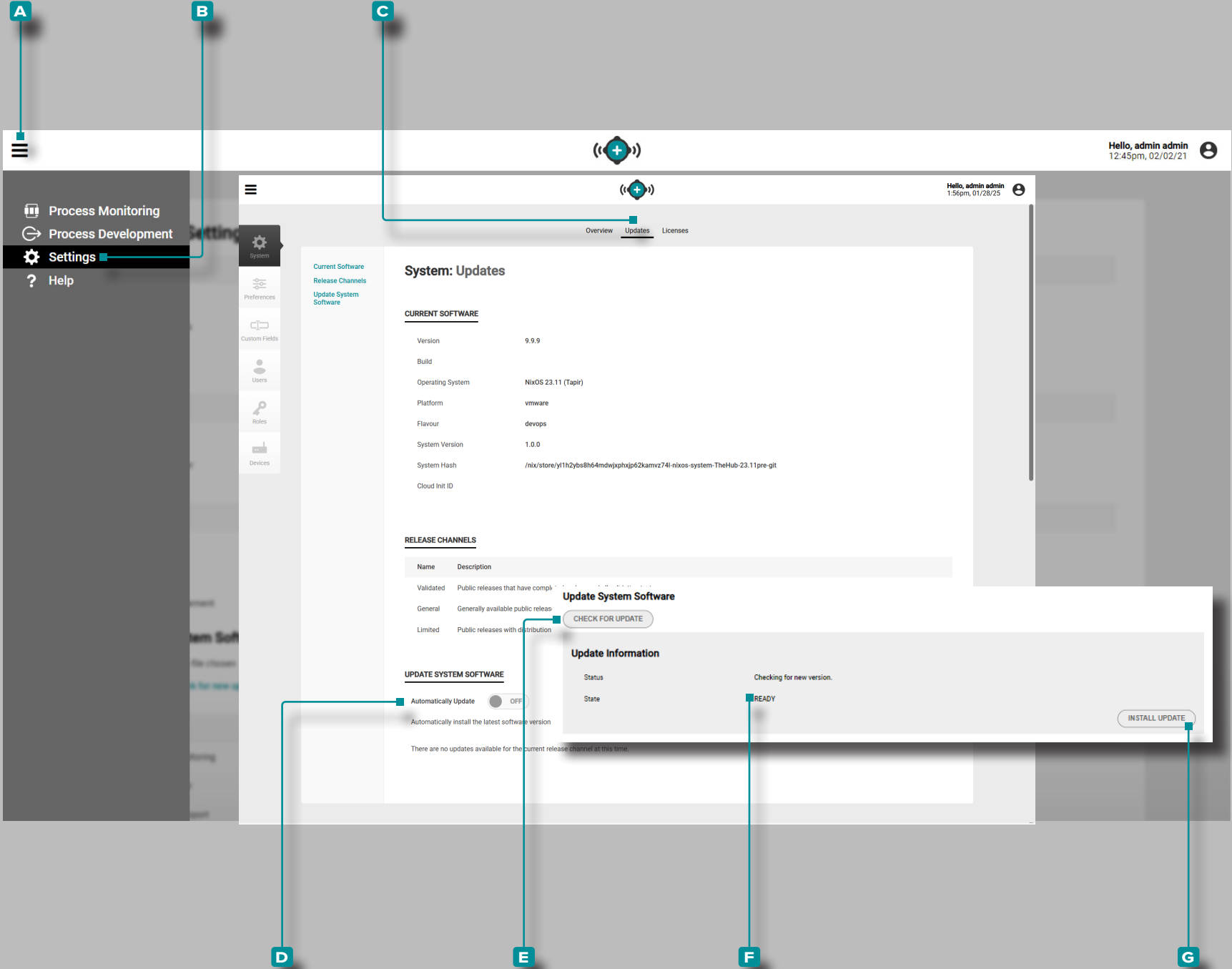
⚡ CAUTION DO NOT skip update versions; DO NOT apply a newer update if an older update is available—i. e. applying v7.2 update to a v7.0 system versus applying v7.1 update to a v7.0 system, then applying the v7.2 update. Refer to the RJG website to ensure that the correct update is applied to the CoPilot system. Failure to comply may result in errors or issues in the CoPilot software and The Hub system.

Download software update files from www.rjginc.com.

Click the **A** menu icon, click **B** Settings, then click the **C** Updates tab heading. Click the **D** Choose File button under the “Update System Software” heading to browse for an update file.

Select the **E** update file (.UPD) from the window, then click the **F** Open button. Click the **G** UPLOAD button; once the upload is complete, then click the **H** INSTALL UPDATE button. Allow the system to update; when the update is complete, refresh the page (press F5 on the keyboard) and confirm that The Hub software version is updated.

Settings (continued)



Updating a NixOS System

A NixOS system The Hub software (one that runs on a Virtual Appliance (VA)) can be updated directly from System Settings. Update The Hub software as necessary for the latest bug fixes and new features.

CAUTION DO NOT skip update versions; DO NOT apply a newer update if an older update is available—i. e. applying v7.2 update to a v7.0 system versus applying v7.1 update to a v7.0 system, then applying the v7.2 update. Refer to the RJG website to ensure that the correct update is applied to the CoPilot system. Failure to comply may result in errors or issues in the CoPilot software and The Hub system.

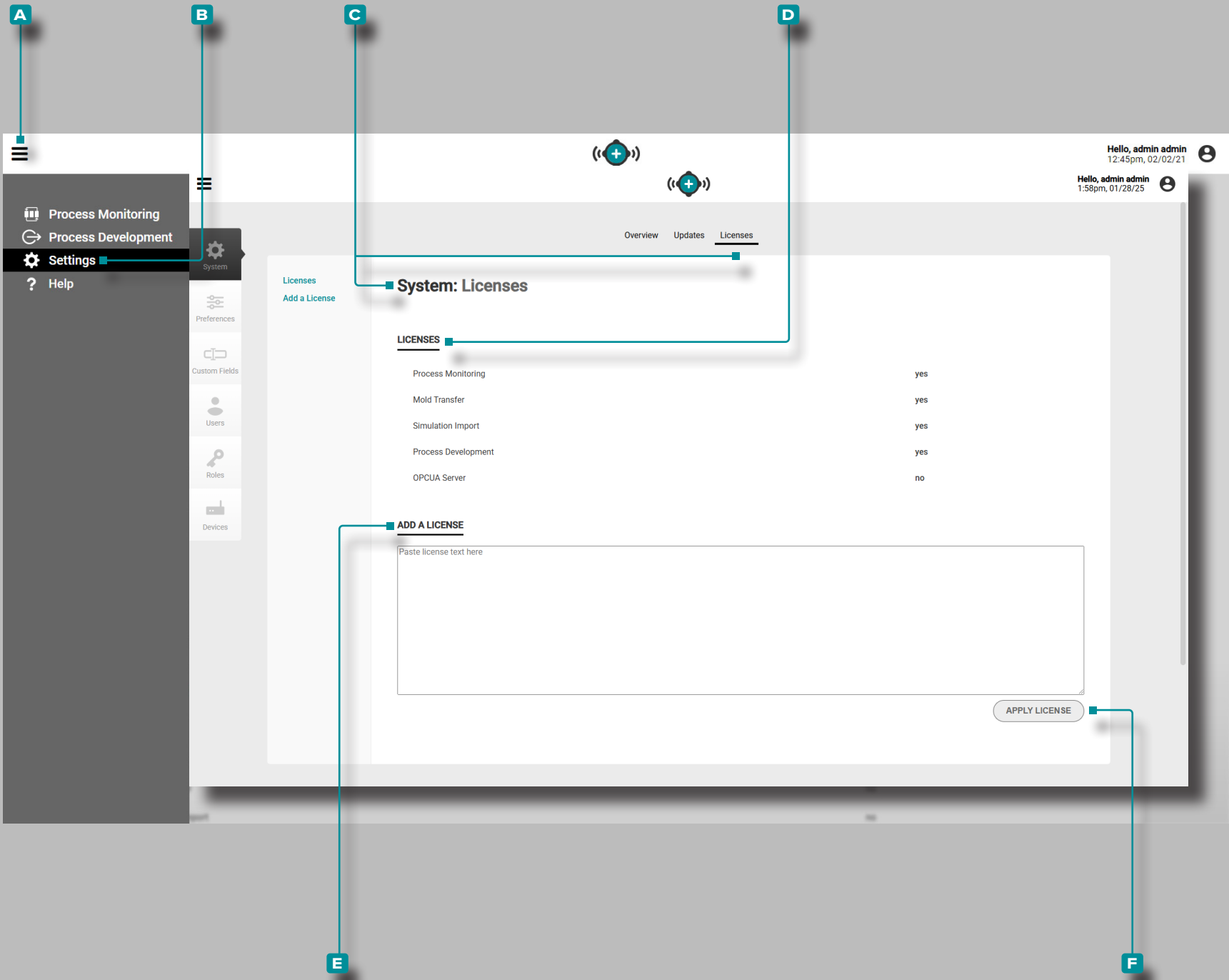
NOTE A user must be logged in to perform a system update.

Updates will be automatically applied if the Automatically Update option is selected to ON, any updates that are published for the currently-selected release channel will be applied without user intervention.

Click the **A** menu icon, click **B** Settings, then click the **C** Updates tab heading. The **D** Automatically Update slider must be selected to ON for updates to be automatically applied.

Alternatively, click the **E** CHECK FOR UPDATE button to browse for an update file. If an update is available, and a **F** READY state is displayed, click the **G** INSTALL UPDATE button. Allow the system to update; when the update is complete, refresh the page (press F5 on the keyboard) and confirm that The Hub software version is updated.

Settings (continued)



System Settings: Licenses

The Hub **C** [System Settings: Licenses](#) includes **D** [Licenses](#) status and the **E** [Add a License](#) function. The software must be licensed for use with CoPilot systems. Some features may not be available to core-only licensed users.

Click **A** the **A** menu icon from any page, then click **B** [Settings](#) to access overview, updates, and licenses information.

Licenses

The System Settings **D** [Licenses](#) displays which licenses are active on the system, including: process monitoring, mold transfer, simulation support, process development, and OPC UA server.

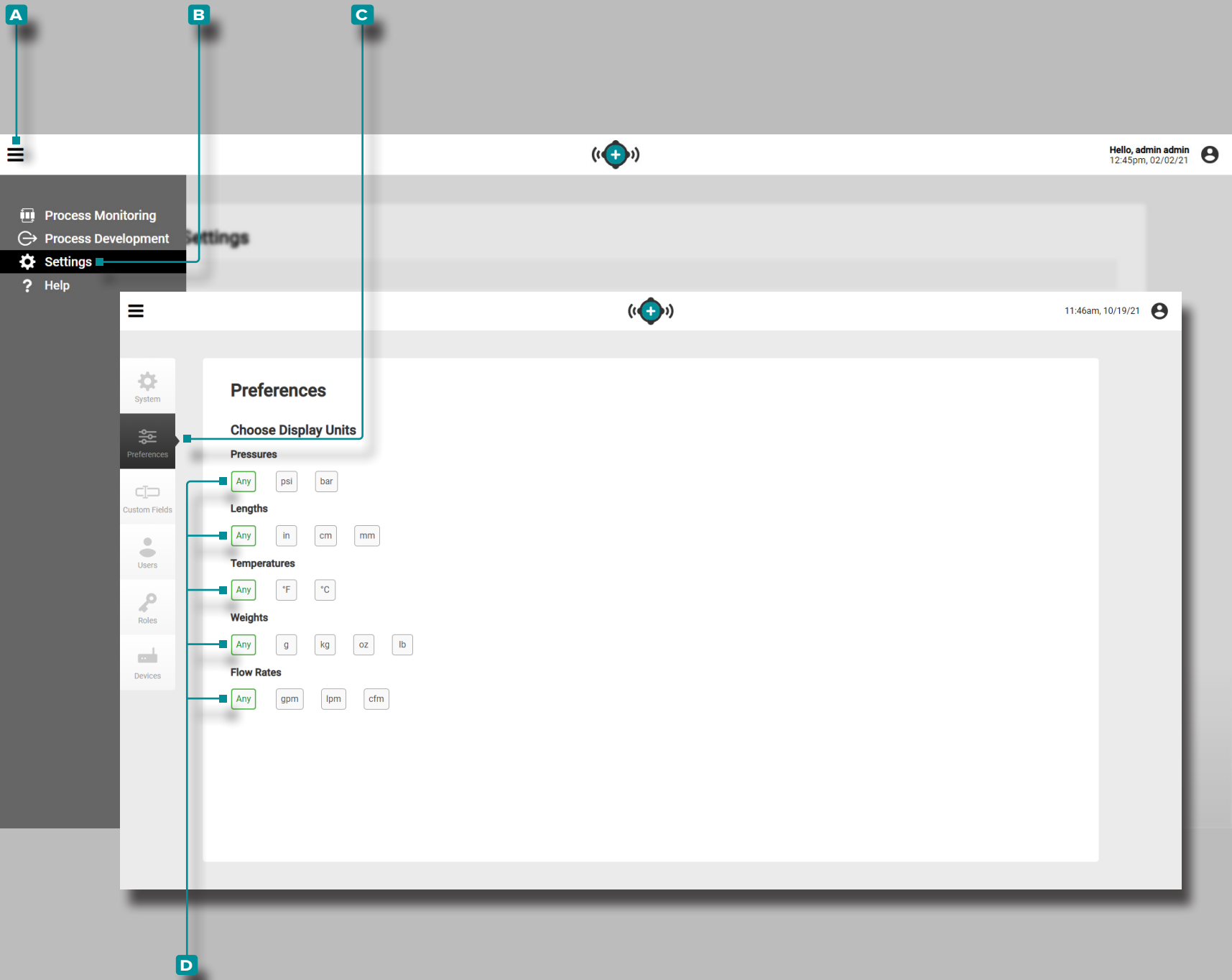
Add a License

The **C** [System Settings: Licenses](#) provides an **E** [Add a License](#).

Click **A** the **A** menu icon, click **B** [Settings](#), and then click **C** [Licenses](#).

Copy (Ctrl+C) and **Paste** (Ctrl+V) the license text into the **E** [Add a License](#) field; click **F** the [Apply License](#) button to apply the license.

Settings (continued)



Preferences

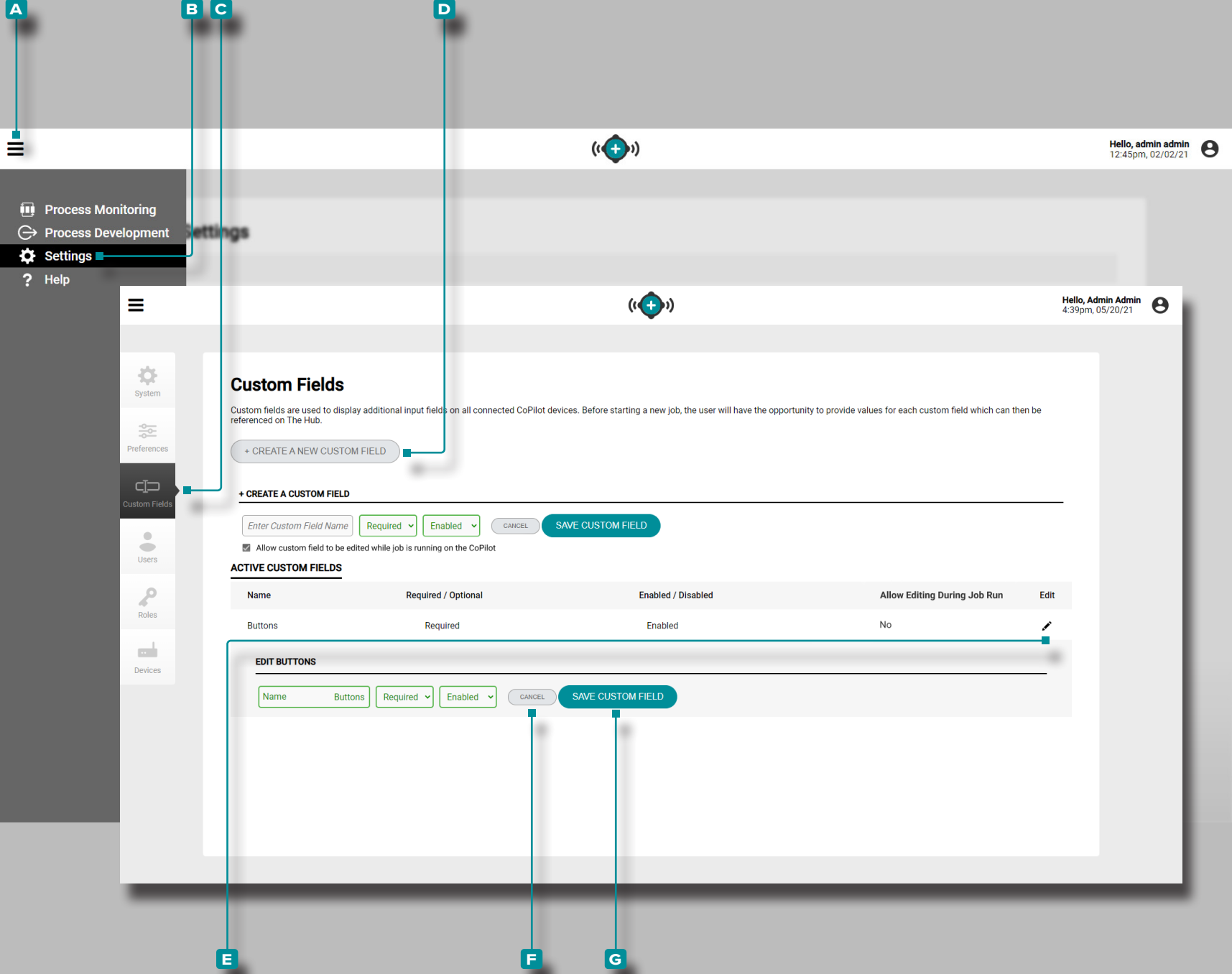
Manage display units of measurement for The Hub and CoPilot softwares from the Preferences view.

Choose Display Units

Users can select the desired display units of measurement for pressures, lengths, temperatures, weights, and flow rates in The Hub and CoPilot softwares.

Click the **A** menu icon, then click **B** Settings, then click **C** Preferences. Under each category, click to select the desired **D** display units of measurement.

Settings (continued)



Custom Fields

Manage, add, or edit custom fields for The Hub and CoPilot softwares from the Custom Fields view.

NOTE There is a limit of three (3) custom fields that can be displayed on the CoPilot system during a job.

Create a New Custom Field

Click the **A** menu icon, then click **B** Settings, then click **C** Custom Fields.

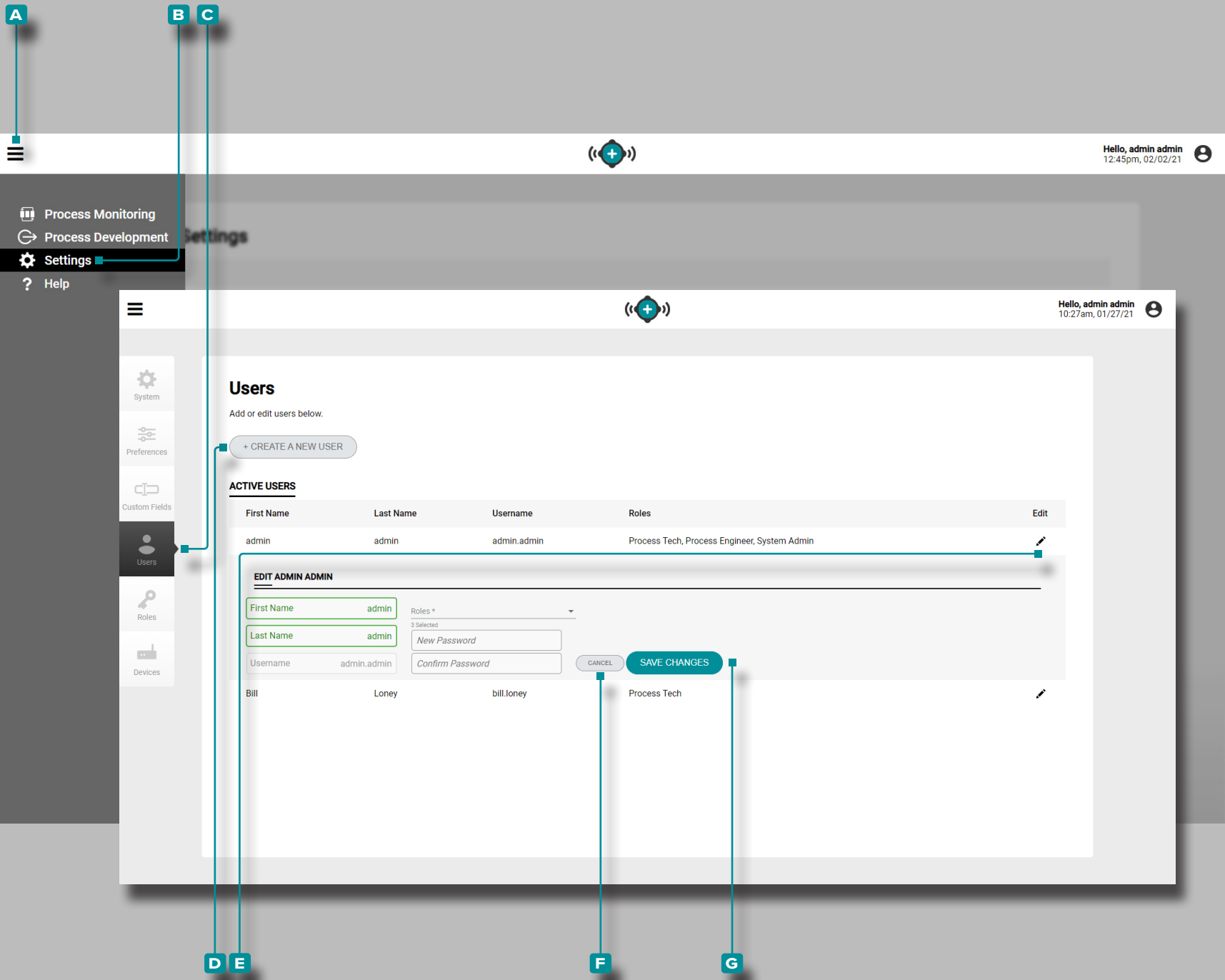
Click the **D** Create a New Custom Field button to add a new custom field to the system; **enter** the required information and select if the field is required or optional, and enabled or disabled for the custom field from the drop-down menus.

Edit an Existing Custom Field

Click the **A** menu icon, then click **B** Settings, then click **C** Custom Fields.

Click the **E** edit icon next an existing user to edit the custom field; click the **F** Cancel button to discard any changes or, click the **G** Save Changes button to save any changes.

Settings (continued)



Users

Manage, add, or edit users for The Hub and CoPilot softwares from the Users view.

Create a New User

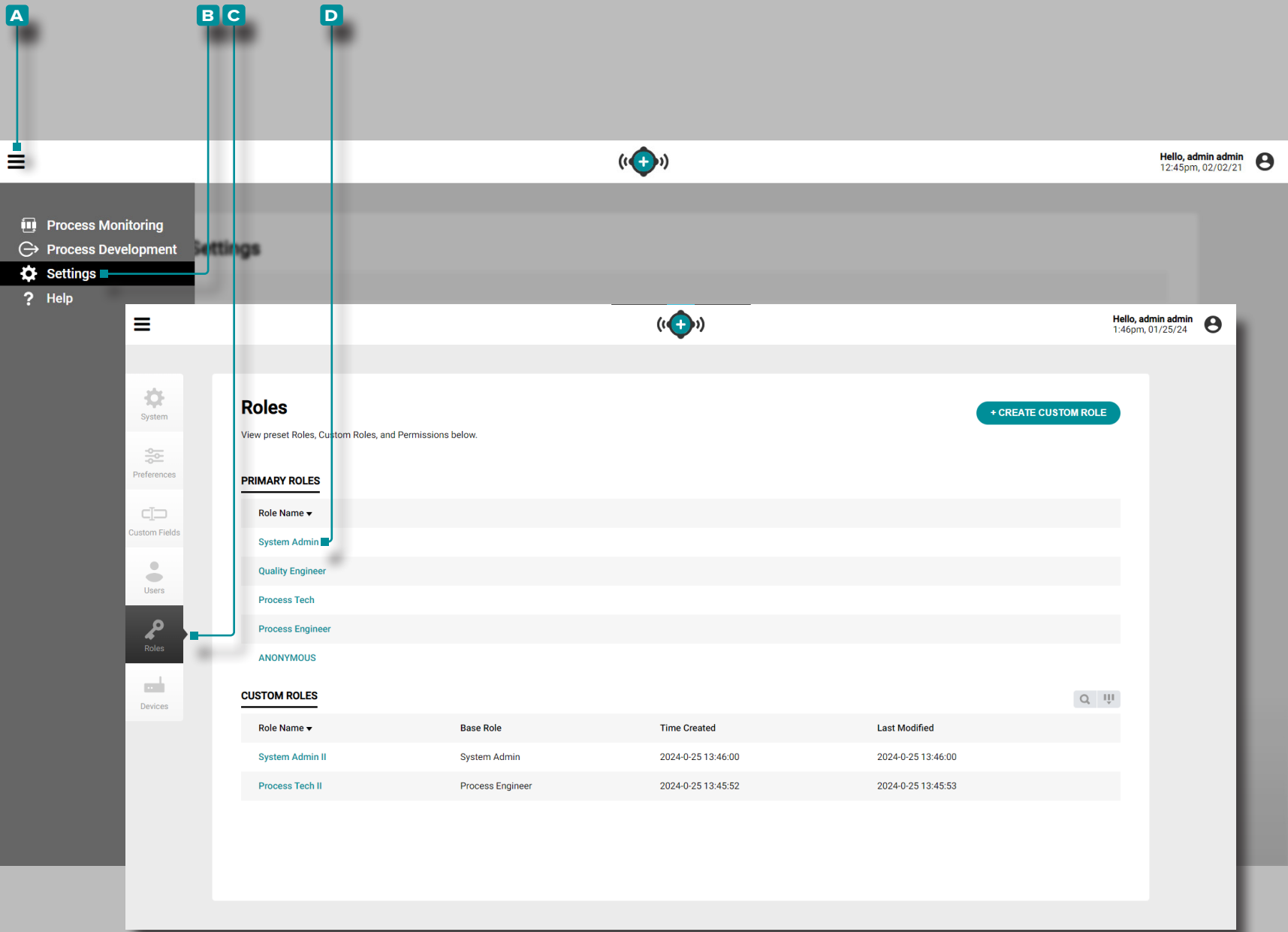
Click the **A** menu icon, then click **B Settings**, then click **C Users**.

Click the **D Create a New User** button to add a new user to the system; **enter** the required user information and select a role for the user from the drop-down menu.

Edit an Existing User

Click the **A** menu icon, then click **B Settings**, then click **C Users**.

Click the **E edit** icon next an existing user to edit the user account; click the **F Cancel** button to discard any changes or, click the **G Save Changes** button to save any changes.



Settings (continued)

Roles

Manage, view, create, or edit user roles for The Hub and CoPilot softwares from the Role List.

Click the **A** menu icon, then click **B** Settings, then click **C** Roles. Click the **D** Role Name to view associated permissions for each Role.

Primary Roles

The pre-defined roles System Admin, Process Tech, Process Engineer, and QC Engineer include permissions for creating, reading (viewing), editing, deleting, or other actions for each function in The Hub and CoPilot software. Primary Role Permissions

Custom Roles

Custom Roles can be created in The Hub including permissions for creating, reading (viewing), editing, deleting, or other actions for each function in The Hub software and CoPilot system. Refer to "Create Custom User Roles" on page 102 and "Edit Custom User Roles" on page 103 for more information on custom roles.

Permissions

Permissions are divided into three categories: Global Permissions, The Hub Permissions, and CoPilot Permissions; refer to "Global Role Permissions" on page 99, "The Hub Software Role Permissions" on page 100, and "CoPilot System Role Permissions" on page 101.

Settings (continued)

Global Role Permissions

Global permissions are any actions that can take place in either The Hub software or the CoPilot system. The table below displays the shared permissible actions for each preset role for The Hub software and CoPilot system.

FUNCTION	QUALITY ENGINEER	SYSTEM ADMIN	PROCESS ENGINEER	ANONYMOUS	PROCESS TECHNICIAN
Advice	Read	Read	Read, Allow	Read	Read
Job Valve Gate Configuration		Read	Read, Edit	Read	Read
Machine Setup	Read	Read	Create, Read, Edit, Delete	Read	Read
Material Setup	Read		Create, Read, Edit, Delete	Read	Read
Mold Setup	Read	Read	Create, Read, Edit, Delete	Read	Read
Notes			Create, Read, Edit		Read, Edit
Part Parents	Create, Read, Edit	Read	Create, Read, Edit	Read	Read
Part Samples	Read	Read	Read	Read	Read
Part Setup	Create, Read, Edit, Delete		Create, Read, Edit, Delete	Read	Read
Process Setup	Read		Create, Read, Edit, Delete	Read	Read
Sensor Lists	Read	Read	Read	Read	Read
Set Template			Allow		Read
Submit Help Request		Allow	Allow		Allow
System Diagnostics		Read	Read	Read	Read
System Settings	Read	Read, Edit	Read, Edit	Read	Read
System Timezone	Read	Read	Read	Read	Read
Template Match	Read	Read	Read, Edit	Read	Read
Templates	Read	Read	Create, Read, Edit, Delete	Read	Read
V2P	Read	Read	Read, Edit	Read	Read

Settings (continued)

The Hub Software Role Permissions

The Hub permissions are any actions that can take place in The Hub software. The table below displays the permissible actions for each preset role in The Hub software.

FUNCTION	QUALITY ENGINEER	SYSTEM ADMIN	PROCESS ENGINEER	ANONYMOUS	PROCESS TECHNICIAN
Apply System Licenses		Allow			
Apply System Updates		Allow			
Configurations	Read	Read, Edit	Read, Edit	Read	Read
Critical to Quality Characteristics	Edit		Edit		
Custom Fields	Read	Create, Read, Edit	Read	Read	Read
Disable eDARTs		Allow			
Disable Users		Allow			
eDARTS		Read	Read		Read
EULA Acknowledgments		Create			
Job Cycle Graphs	Read	Read	Read	Read	Read
Job Trends	Read	Read	Read	Read	Read
Jobs	Read	Read	Read	Read	Read
Jobs Summary	Read	Read	Read	Read	Read
Measurements	Edit		Edit		
User Roles		Create, Read, Edit, Delete			
Users		Create, Read, Edit			

Settings (continued)

CoPilot System Role Permissions

CoPilot permissions are any actions that can take place in the CoPilot system. The table below displays the permissible actions for each preset role in the CoPilot system software.

FUNCTION	QUALITY ENGINEER	SYSTEM ADMIN	PROCESS ENGINEER	ANONYMOUS	PROCESS TECHNICIAN
Apply System Updates		Allow			
Clear Excessive Rejects			Allow		Allow
Configurations	Read	Create, Read, Edit	Create, Read, Edit	Read	Read
Cycle Advice			Read		Read
Display Units	Read	Read, Edit	Read, Edit	Read	Read, Edit
Enable Injection			Allow	Read	Allow
Job	Read	Read	Read, Edit	Read	Read, Edit
Offline Override			Allow		Read
Previous Cycle	Read	Read	Read	Read	Read
Raw Data Viewer		Read	Read	Read	
Set Screw Bottom			Allow		Allow
Sorting Options			Read, Edit		Read
Start/Stop Job			Allow		Allow
System Logs		Read	Read		Read
Toggle Outputs			Allow		Allow
Toggle Part Samples	Allow		Allow		Allow
Toggle Sequencer		Allow	Allow		Allow
Zero Hydraulic Pressure			Allow		Allow

Settings (continued)

Create Custom User Roles

- NOTE

Only users with a designated Admin role within the software have the required permission to create custom roles.
- NOTE

Up to ten (10) custom roles may be created within The Hub software by an Admin user.

Custom Roles are created by selecting an existing base role and adapting it to create the desired permissioned role.

Click the **A** +Create Custom Role icon, then click to select the desired **B** Base Role to adapt in the drop-down menu.

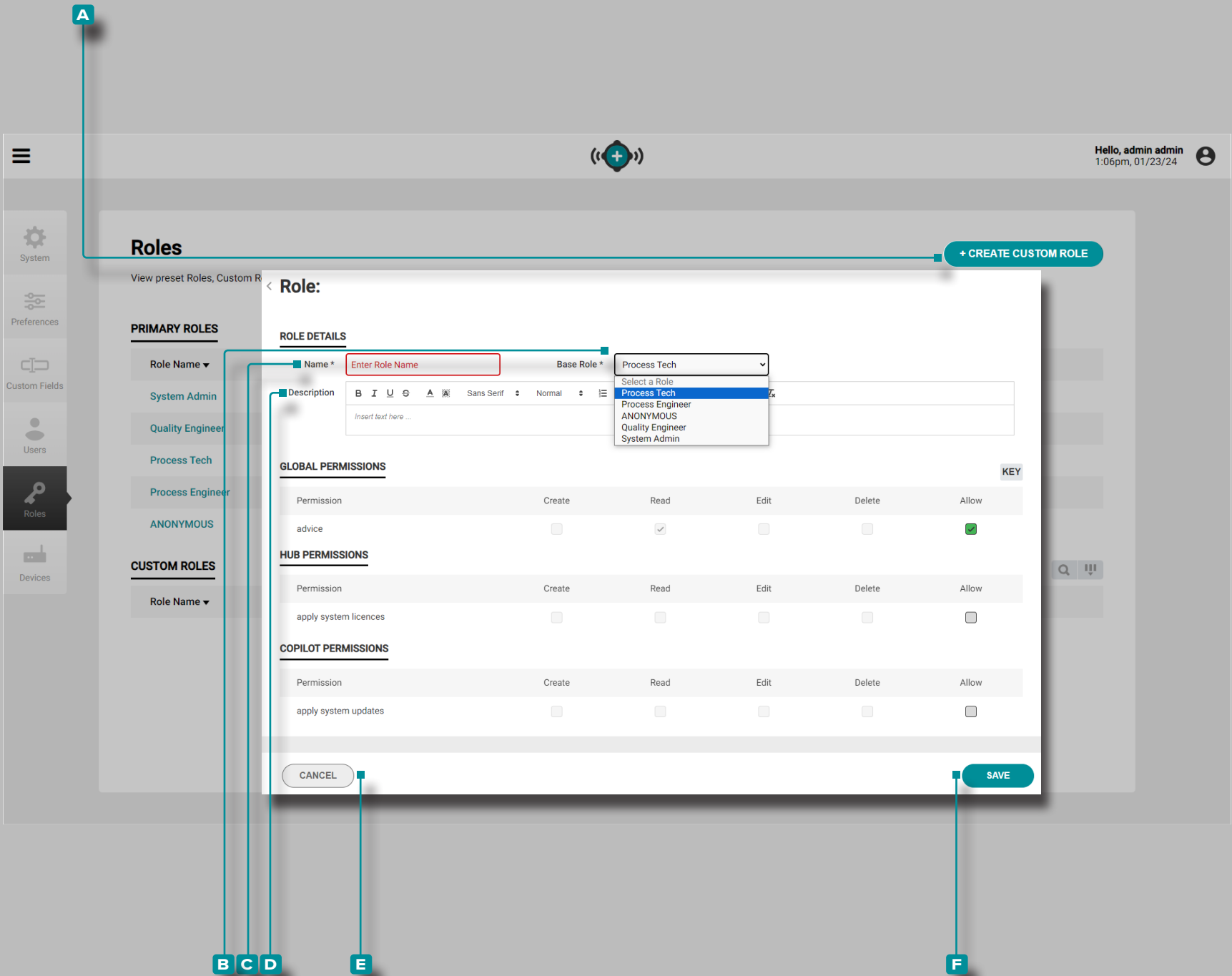
Click the **C** name field and enter the desired role name. The name can be up to 25 characters, and no duplicate names are permitted.

Enter a description in the **D** Description field if desired. A description is not required, and there is no character limit.

Some Global, The Hub, and CoPilot permissions are assigned or prohibited depending on the selected Base Role. If a permission is prohibited to change for the Base Role, it cannot be selected/deselected for the custom role; prohibited permissions checkboxes are greyed out. Permissions that are required are displayed in a grey checkbox with a charcoal check mark; required permissions cannot be deselected.

Permissions that are adaptable from the base role permissions are displayed in a green checkbox with a black check mark; permissions that are not part of the base role, but can be assigned during role customization are displayed in a grey checkbox until selected, and then are displayed in a green checkbox with a white check mark.

Click to select or deselect the desired Global, The Hub, and/or CoPilot permissions for the custom role. Click the **E** CANCEL button to cancel any changes, or click the **F** SAVE button to save the Custom Role.



Settings (continued)

The screenshot displays the 'Roles' management interface. On the left, a sidebar contains navigation links: System, Preferences, Custom Fields, Users, Roles (highlighted), and Devices. The main content area is titled 'Roles' and includes a 'View preset Role' button. Below this, there are sections for 'PRIMARY ROLE' and 'CUSTOM ROLES'. The 'CUSTOM ROLES' section lists several roles, including 'System Admin II' and 'Process Tech II'. A modal window is open, showing the details for the 'System Admin II' role. This modal has a 'ROLE DETAILS' section with fields for 'Name' (System Admin II) and 'Base Role' (System Admin). Below this is a 'GLOBAL PERMISSIONS' table. At the bottom of the modal are 'CANCEL' and 'SAVE' buttons. Callout A points to the 'Custom Roles' section in the sidebar. Callout B points to the 'EDIT' button in the modal. Callout C points to the 'CANCEL' button in the modal. Callout D points to the 'SAVE' button in the modal.

ROLE DETAILS

Name: System Admin II Base Role: System Admin

Description:

GLOBAL PERMISSIONS

Permission	Create	Read	Edit	Delete	Allow
advice	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
job valve gate configuration	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
machine setup	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
material setup	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
mold setup	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
notes	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
part parents	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
part setup	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

CUSTOM ROLES

Role Name: System Admin II

Process Tech II

EDIT

CANCEL **SAVE**

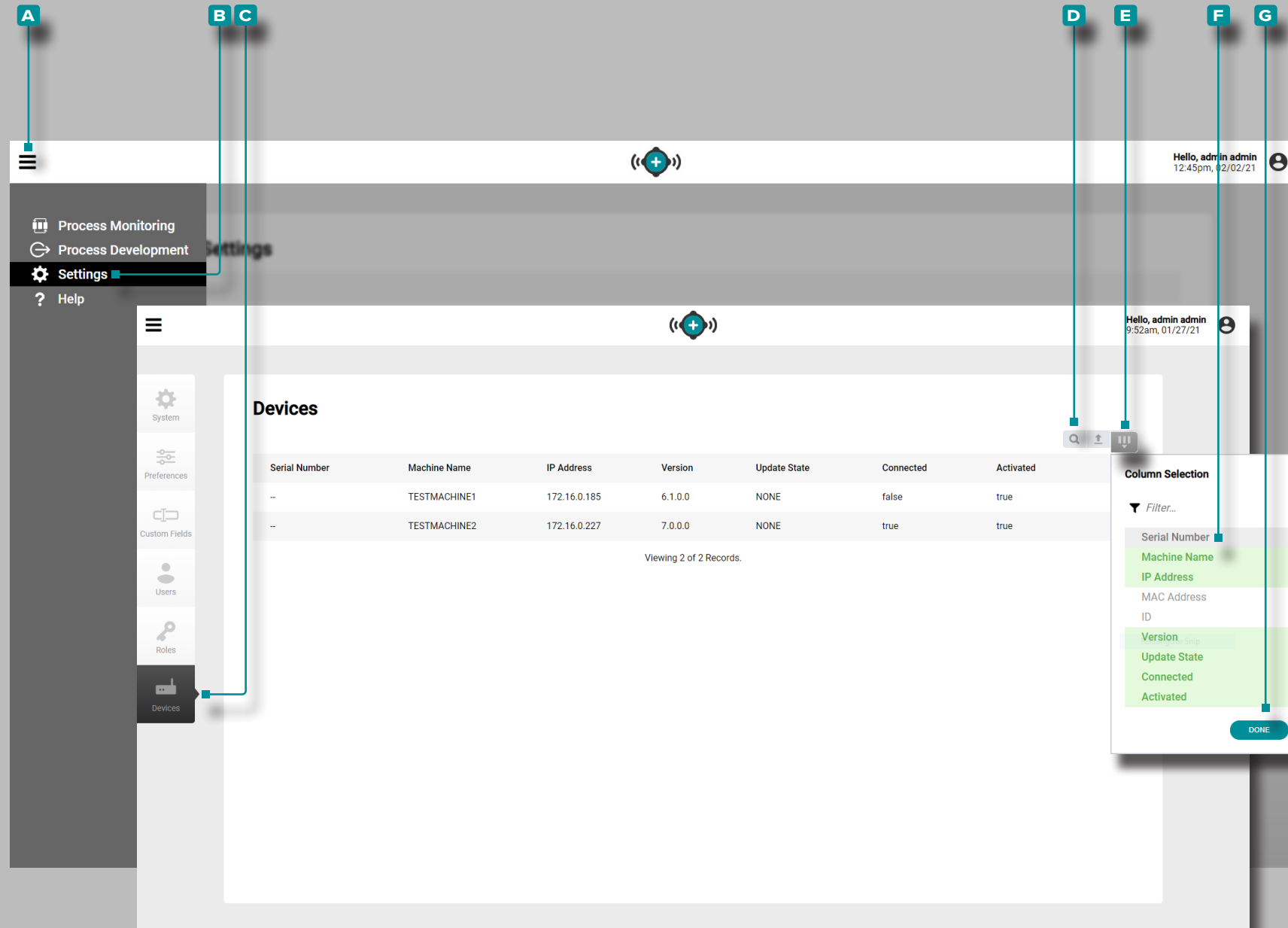
Edit Custom User Roles

Custom Roles can be edited to include or exclude global, The Hub software, and/or CoPilot system permissions.

Click the **A** Custom Role to edit, then click to the **B** EDIT button. Edit the Name, **i**Base Role, or permissions as desired.

NOTE If the Base Role is changed, permissions applied to the custom role previously will be deleted.

Click the **C** CANCEL button to cancel any changes, or click the **D** SAVE button to save the changes to the Custom Role.






Settings (*continued*)


Devices




The Devices view provides details of each CoPilot system in the network including serial number.

The Devices view can displays up to 9 of the following device variables:

- Serial Number
- Machine Name
- IP Address
- MAC Address
- ID
- Version
- Update State
- Connected
- Activated

Click  the **A** menu icon, then click  **Settings**, then click  **Devices** to view CoPilot system network information.

Click  the **D** search icon to enter/search for a word or phrase among the devices.

Click  **Select Columns** to choose the displayed  variables. Click  the **DONE** button to save changes and exit the Select Columns pop-up window.

Settings (continued)

CoPilot Systems Updates

The connected CoPilot systems can be updated directly from The Hub, from the Devices page. Update the connected CoPilot systems as necessary for the latest bug fixes and new features.

⚠ CAUTION DO NOT skip update versions; DO NOT apply a newer update if an older update is available—i. e. applying v7.2 update to a v7.0 system versus applying v7.1 update to a v7.0 system, then applying the v7.2 update. Refer to the RJG website to ensure that the correct update is applied to the CoPilot system. Failure to comply may result in errors or issues in the CoPilot software and The Hub system.

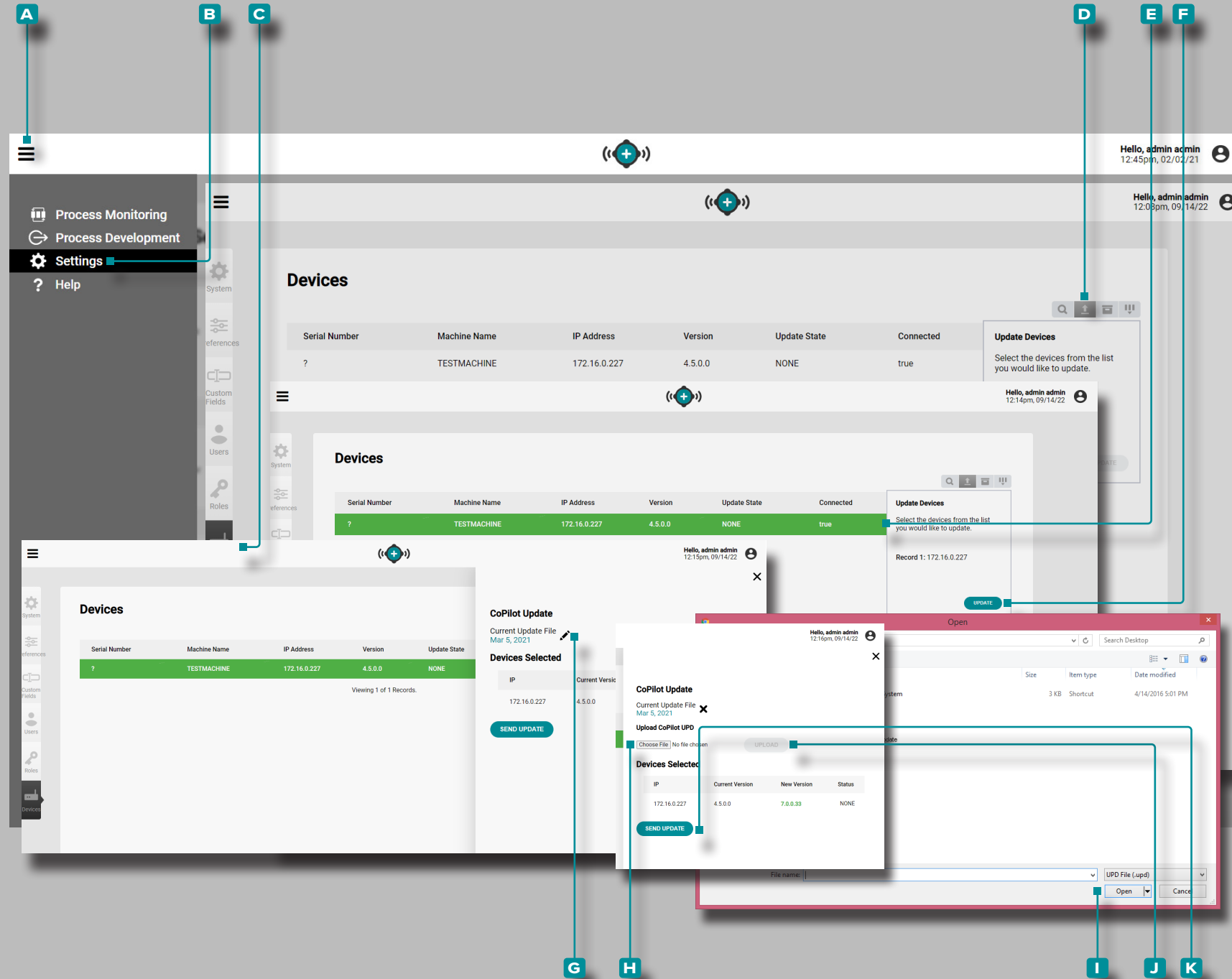
Click the **A** menu icon, then click **B** Settings, then click **C** Devices to view CoPilot system network information.

Click the **D** Update Devices button, and then click on the desired **E** CoPilot devices in the list to select or deselect them for update; the selected rows (devices) will turn green. Click the **F** UPDATE button to continue with the update

Click the **G** pencil icon on the slideout window, then click the **H** Choose File button. Select the update file (.UPD) from the window, then click the **I** Open button. Click the **J** UPLOAD button; wait for the upload to complete, then click the **K** SEND UPDATE button.

Once the status displays “Transfer Complete Success”, the update will be available on the selected CoPilot systems.

(continued on next page)



Settings (continued)

COPILOT®

MONTIOR PROCESS

or log into your account below:

Username

Enter Password

SIGN IN

NOTIFICATIONS

New System Update Available. Please update your CoPilot to Version 8.4.0.

COPILOT®

You are currently signed in as a user

SIGN OUT

NOTIFICATIONS

New System Update Available. Please update your CoPilot to Version 8.4.0.

UPDATE NOW

(continued from previous page)

The CoPilot systems that received the update will display an **A** update notification on the login screen. To complete the updates, sign in to each CoPilot system, then select the **B** UPDATE NOW button on each CoPilot system's login screen.

CAUTION Each CoPilot system must be rebooted after updates are installed. Ensure the machine is stopped before rebooting each CoPilot system.

To ensure the CoPilot update has installed successfully, refresh the Devices page on The Hub to view the current CoPilot system software version.

Settings (continued)

The Hub IP Address

The Hub IP address is preset at RJG, Inc (10.0.0.10 (IP Address) 255.255.255.0 (Subnet Mask)). The Hub Server IP address must be set in each CoPilot system configuration.

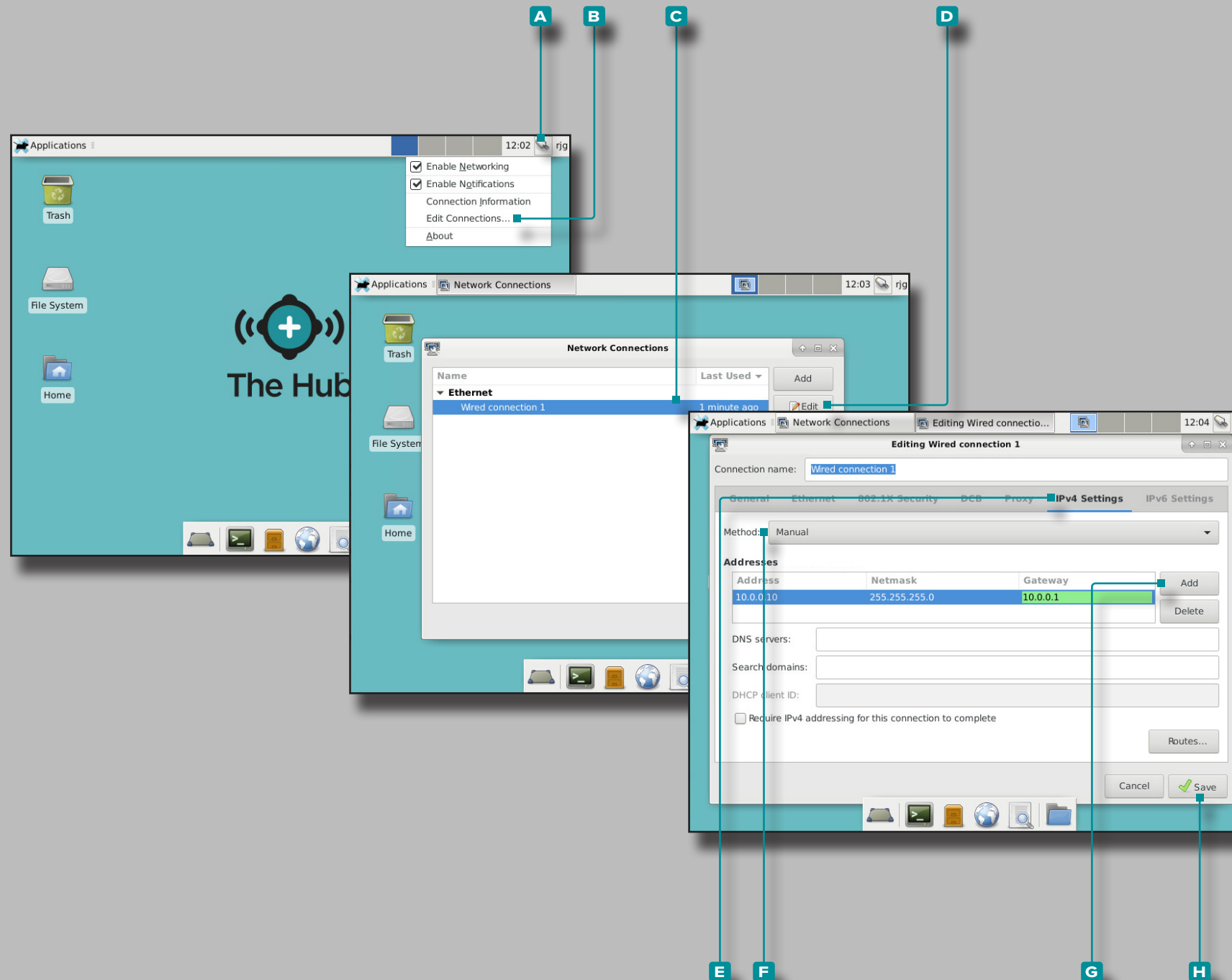
If a The Hub system network with assigned IP address exists, The Hub IP address may be changed to match the current CoPilot systems configuration; the change can be made through the graphical user interface (GUI, preferred method) or by command prompt. Read and follow all instructions to change The Hub IP address, if desired.

Change by GUI

1. Log in to The Hub server.
2. Click the **A** network connection icon next to the username "rjg", then click **B** Edit connections.
3. Click the **C** wired connection, then click **D** edit.
4. Click **E** IPv4 Settings, then click the **F** desired connection method; enter the Address, Netmask, and Gateway desired.

If setting a static address, select **F** Manual and then click **G** add and enter the Address, Netmask, and Gateway options with the appropriate address.

5. Click the **H** save button to save and exit.



Settings (*continued*)

```
GNU nano 2.7.4      File: /etc/network/interfaces      Modified
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

source /etc/network/interfaces.d/*

# The loopback network interface
auto lo
iface lo inet loopback

auto eno1
iface eno1 static
address 10.0.0.10
netmask 255.255.255.0
gateway 10.0.0.1

auto eno2
iface eno2 dhcp
```

Change by Command Prompt

1. Log in to The Hub application server.
2. At prompt `rjg@TheHub:` **enter** `|` `sudo nano /etc/network/interfaces` and return/enter on the keyboard.
3. **Enter** `|` the Address, Netmask, and Gateway desired.

Diagnostics

2:51pm, 07/08/25

Diagnostics: Disk Usage

Name	Path	Usage	Size	Used	Available	Used %
/dev/sda1	/	Primary Data Backup, Database	33.22 GB	23.31 GB	8.19 GB	71%
tmpfs	/run		0.39 GB	41 MB	0.35 GB	11%
tmpfs	/run/lock		5 MB	0 MB	5 MB	0%
tmpfs	/sys/fs/cgroup		1.93 GB	0 MB	1.93 GB	0%
tmpfs	/run/user/111		0.39 GB	0 MB	0.39 GB	1%

Process Monitoring

Process Development

Settings

Help

2:47pm, 07/08/25

Diagnostics: Disk Usage

Path	Usage	Size	Used	Available	Used %
/	Primary Data Backup, Database	33.22 GB	23.31 GB	8.19 GB	71%
/run		0.39 GB	41 MB	0.35 GB	11%
/run/lock		5 MB	0 MB	5 MB	0%
/sys/fs/cgroup		1.93 GB	0 MB	1.93 GB	0%
/run/user/111		0.39 GB	0 MB	0.39 GB	1%

Help

Diagnostics: Disk Usage

The **A** **Diagnostics** view provides **B** **Disk Usage** information. Click the **J** **menu** icon from any page, then click **K** **Help** to access **A** **Diagnostics**.

Disk Usage

The **B** **Disk Usage** view provides **H** **Name**, **I** **Path**, **C** **Usage**, **D** **Size**, **E** **Used**, **F** **Available** and **G** **Used %** disk information.

Name

The **H** **Name** assigned to the disk.

Path

The file **I** **Path** location.

Usage

A description of the disk **C** **Usage**, for example "Primary Data Backup".

Size

The total storage **D** **Size** of the disk.

Used

The amount of disk space that is currently **E** **Used** by data.

Available

The amount of free disk space that is still **F** **Available** for use.

Used Percent

The **G** **Used Percentage** of the total disk space that is currently in use.

Appendix

Mold Launch, Mold Transfer, and Simulation Support Machine Compatibility

The Launch a New Mold, Transfer a Mold, and Simulation Support tools provide a list of recommended machines for use with the selected mold based on the following user-entered machine and mold information:

- Mold Fit (vertical and horizontal tie bar dimensions, vertical and horizontal platen dimensions, minimum and maximum mold height, ejection clearance, and maximum platen daylight dimension)
- Clamp Force (process vs. machine maximum clamp force)
- Injection Rate (process vs. machine maximum flow rate)
- Injection Pressure (process vs. machine maximum injection pressure)
- Injection Capacity (process shot volume vs. machine maximum barrel capacity)

Machine compatibility is shown using the following colors:

- green indicates that one or more of a machine’s capabilities is compatible and can provide the necessary process requirements;
- yellow indicates that one or more of a machine’s capabilities may not be compatible with the current process requirements;
- red indicates that one or more of a machine’s capabilities are not capable of providing the necessary process requirements.

The following tables detail the requirements that determine a mold and machine’s compatibility/color code.

CLAMP UNIT

Clamp Type*

Hydraulic

MIN Clamp Force*

10

ton

MAX Clamp Force*

100

ton

Ejector Stroke

4

in

Ejector Force

200

lbf

MAX Daylight*

20

in

Platten Horizontal Length*

20

in

Platten Vertical Length*

20

in

TIE BAR

Horizontal Clearance*

20

in

Vertical Clearance*

20

in

MIN Mold Height*

4

in

CLAMP UNIT

Clamp Type*

Toggle

Opening Stroke*

MIN Clamp Force*

10

ton

MAX Clamp Force*

100

ton

Ejector Stroke

4

in

Ejector Force

200

lbf

Platten Horizontal Length*

20

in

Platten Vertical Length*

20

in

TIE BAR

Horizontal Clearance*

20

in

Vertical Clearance*

20

in

MAX Mold Height*

MIN Mold Height*

4

in

110

Appendix (continued)

Mold Fit

NOT COMPATIBLE/RED	NOT RECOMMENDED/YELLOW	COMPATIBLE/GREEN
Mold Length is greater than Machine's Tie Bar Vertical Length	Mold Length is less than 2/3 of Machine's Tie Bar Vertical Dimension	Mold and Machine are Compatible
Mold Width is greater than Machine's Tie Bar Horizontal Dimension		
Mold Length is greater than Machine's Vertical Platen Length		
Mold Width is greater than the Machines Horizontal Platen Dimension		
Mold Height is less than Toggle Machine's Minimum Mold Height	Mold Width is less than 2/3 of Machine's Tie Bar Horizontal Dimension	
Mold Height is greater than Toggle Machine's Maximum Mold Height		
Mold Ejection Clearance is greater than Machine's Clamp Stroke		
Mold Die Height plus Mold Ejection Clearance is greater than Machine's Maximum Platen Day Light Dimension		

Appendix (continued)

Clamp Force		
NOT COMPATIBLE/RED	NOT RECOMMENDED/YELLOW	COMPATIBLE/GREEN
Process Clamp Force is greater than Machine's Maximum Clamp Force	Process Clamp Force is greater than 80% of Machine's Maximum Clamp Force	Mold and Machine are Compatible
	Process Clamp Force is less than Machine's Minimum Clamp Force	
Injection Rate		
NOT COMPATIBLE/RED	NOT RECOMMENDED/YELLOW	COMPATIBLE/GREEN
Process Flow Rate is greater than Machine's Maximum Flow Rate	Process Flow Rate is greater than 80% of Machine's Maximum Flow Rate	Mold and Machine are Compatible
Injection Pressure		
NOT COMPATIBLE/RED	NOT RECOMMENDED/YELLOW	COMPATIBLE/GREEN
Process Injection Pressure is greater than Machine's Maximum Injection Pressure	Process Injection Pressure is greater than 80% of Machine's Maximum Injection Pressure	Mold and Machine are Compatible
Injection Capacity		
NOT COMPATIBLE/RED	NOT RECOMMENDED/YELLOW	COMPATIBLE/GREEN
Process Shot Volume is greater than 90% of Machine's Maximum Barrel Capacity	Process Shot Volume is greater than 80% of Machine's Maximum Barrel Capacity	Mold and Machine are Compatible
Process Shot Volume is less than 10% of Machine's Maximum Barrel Capacity		

Appendix (continued)

Data Import, Export, Backup, and Archival Overview

Users are able to move data from one The Hub system (or Copilot system) to another The Hub system, in order to send data to RJG Customer Support, OEM customers, or transferring data between plants, or mold tryout.

File Format

Data for import, export, and backup is provided in the ZIP file format. The ZIP file format is space-efficient and allows random data access. From the ZIP file format, data is then contained in cbor data structures. This makes the data self-describing to some extent, while still being space-efficient and compatible with current data structures.

Data Structure

The data structure is as follows:

- | | |
|--------------|--------------------|
| • Job | • SummaryData |
| • ChangeLogs | • SummaryVariableX |
| • JobAlarms | • SummaryVariableY |
| • JobLegend | • ... |
| • Notes | • Entities |
| • Cycle | • Machine |
| • 0 | • Mold |
| • 1 | • Process |
| • ... | • SetupSheet |
| • CycleData | • Templates |
| • 0 | • EntityRevisions |
| • 1 | |
| • ... | |

Imported Data

When a job is imported, the job data is written to disk. The job document is inserted into the database with a reference to the job file on the disk. Job data is accessed from the file instead of reading it out of the database. Entity documents can also be optionally imported, depending on the application.

Data Access

Job documents will always be queried from the database. The only time that a job document will be read from a data file is when importing a job file. Other job data will be accessed from the data file if it is present, or from the database if it has not already been written.

If a secondary backup location has been set and the primary data file has been deleted, it will read from the secondary file instead. If the data has been removed from the database and the data file deleted, an error will be returned to notify the user to contact their network administrator to retrieve the data from the archival system. The data must then be imported to access the job data. The user will use the Data Import tool to import the data into the Hub.

Data Backup and Archival

Data backup should be in place and used in the event of hardware failure or data loss/corruption, while data archival is intended for long-term retention.

Data Backup

Data can be imported to The Hub system in the form of a backup file in order to restore The Hub data, or to review previously-backed-up data. When a job is complete, all relevant job data is collected and stored to disk in this file format. The job document is updated with a reference to the file on disk, which is a user-configurable location.

Data Archival

Archived data is intended for long-term data retention. When a job is complete, all relevant job data is collected and stored to disk in this file format. The job document is updated with a reference to the file on disk, which is a user-configurable location.

Data Retention and Cleanup

The user can configure two settings for data retention and cleanup. The first is how long that data stays in the database. This will potentially affect some queries that can be done on the data. For instance, any query that queried cycles across jobs would only work if the data was in the database. Queries on jobs will work. When a job is over the data retention date, the cycle and summary data are removed from the database and the job document is updated so that the data is no longer in the database. The job document will be retained for future access.

The second user setting is the amount of free space to reserve on the system. If there is not enough free space it will delete job data files until there is enough free space. The Hub software will not monitor or cleanup data if a secondary data location is configured. The user must ensure that there is enough space to backup data. The system must be configured with enough space to store data in the database for the retention period, and to store the data files long enough for the archival system to complete backup.

Appendix (continued)

Data Backup and Archival Implementation and Configuration

There are multiple ways that a user can configure backup and archival depending on infrastructure. Data can be stored in a folder that is shared and the location can be monitored by an external system which archives the data to a separate location.

- A backup service can be ran on The Hub that is responsible for archiving data to another location.
- A network file system (NFS) or storage area network (SAN) share can be mounted on The Hub system, and a secondary backup location can be configured for The Hub system to archive data.

Background and Default Configuration

The user can expect the job reference information (historical run information, configuration information, and the reference to the specific ZIP file, etc.) to remain in the database but it will no longer store the historical job run data, which is generally the larger subset of data, in the database; this will be stored in the ZIP file that the job run will create; this allows the the Postgres database to be maintained without it ballooning in size.

- (Default location: /opt/rjg/datafiles)

During The Hub system's installation, the app.properties file is created, mapping out the default Postgres database settings. The Data Backup configuration is also automatically generated inside of the app.properties file and can be modified by the IT Administrator to customize the Data Backup feature to the organization's needs.

- The app.properties file is located in the ESM Jetty directory. (/opt/rjg/esm-jetty/config/app.properties)

An example of the Data Backup default configuration is shown here:

```
postgres.address=127.0.0.1
postgres.port=5432
postgres.user=postgres
postgres.password=postgres
#backup.primaryPath=/mnt/sdb
#backup.secondaryPath=/mnt/nfs
#backup.reserveSpace=1000000000
#backup.databaseExpire=180
```

Data Backup Switches and Configuration

To change the default Data Backup configuration on The Hub, uncomment and modify the necessary configuration switches in the default configuration file.

An example of the new default configuration with Data Backup is shown, here:

```
#backup.primaryPath=/mnt/sdb
#backup.secondaryPath=/mnt/nfs
#backup.reserveSpace=1000000000 #1GB of file space
#backup.databaseExpire=180 #180 days
```

- **backup.primaryPath:** This is the primary data backup storage location should a user change away from /opt/rjg/datafiles
- **backup.secondaryPath:** This is the secondary, or archive, data backup storage location. (The primaryPath copies the data to the secondaryPath and is often used as something like an external thumb drive, HDD, etc.)
- **backup.reserveSpace:** This is the space reserved, in bytes, for updates and running data to be allocated on the system. (The default is 1GB of data)
- **backup.databaseExpire:** This is the number of days before job data is removed from the database. (The default is 180 days)

Customers will contact Customer Support for implementation.

- ① **NOTE** If the default configuration is left untouched but the user specifies the secondaryPath, the data will be defaulted to /opt/rjg/datafiles while the /opt/rjg/esm-jetty/config/app.properties secondaryPath mapped location will receive the backed-up copy.
- ① **NOTE** When the primaryPath and secondaryPath are set, the data inside of the primaryPath is automatically copied to the secondaryPath location.
- ① **NOTE** When the backup.reserveSpace is exceeded, the system will delete the larger and newest files, first.

Overview

Most characteristics of injection molded parts can be predicted or “correlated” to in-cavity variables. Correlations between part quality characteristics and in-cavity variable can be found by determining which characteristics are important, which variables can be used to change the part and how, doing an experiment (part sampling), and measuring the parts.

There are three basic levels of part quality characteristic problems:

- **Level One**—Characteristics that can be seen without measurement.
Part Quality Characteristic Problems: short shots, flash and some sinks.
- **Level Two**—Characteristics that usually do not destroy the part in the measurement, but are not visible.
Part Quality Characteristic Problems: dimensions, weight, warp, balance, and others.
- **Level Three**—Characteristics that usually require destructive testing.
- **Part Quality Characteristic Problems:** strength (tensile, compressive, impact), chemical resistance, and others.

Part quality characteristic problems can be controlled by the in-cavity variables—or “Four Plastics Variables”—melt temperature, flow rate, pressure, and cooling (rate and time).

Planning a Part Quality Characteristic to Process Data Correlation Experiment

NOTE *Plenty of literature and courses exist on designed experiments that may be more efficient or advanced techniques than those described in the following text.*

1. Choose Important Part Quality Characteristics

Level one part quality characteristics can and often are remedied simply by stabilizing a process and setting alarms above and below the average for peaks or integrals. Level two and three part quality characteristics are less obvious and require a correlation study.

2. Determine Measurement of Part Quality Characteristics

Ensure that measurement equipment and techniques are accurate and repeatable. The results of a “Gage Repeatability Study” will ensure measurements will be valid. The resolution and accuracy must exceed the tolerance requirements by a minimum factor of 3. Find a way to assign numeric inputs to each (for example, how much chemical resistance is necessary). If parts require any post-molding stabilization, make sure it is repeatable.

Test the measurement plan on some parts to verify it works, and to determine how much time it takes.

Appendix (continued)

3. Determine which Plastic Variables Affect the Chosen Part Quality Characteristics

- **Dimensions**
Pressure (usually seen in cycle integrals, or sometimes pressure drop); or sometimes cooling rate and time in semi-crystalline.
Melt temperature and mold temperature are important in crystalline materials. Flow orientation affects dimensions in glass filled materials (affected by gate sequencing). Back pressure and screw design can also affect glass-filled materials by cutting up the fibers.
- **Weight**
Pressure including packing, and then discharge after pack, or at end of hold (not controlled).
- **Warp**
Cooling rate, pressure (static pressure loss)—gate sealed or not (or amount of seal), and temperature.
- **Texture**
Flow (cavity fill times) during the first part of pressure (fill and pack times and integrals).
- **Crystallinity (and properties affected by it)**
Cooling, melt temperature, and mold temperature.
- **Level 3 Part Quality Characteristic**
Contact material supplier for many level 3 part quality characteristics (impact resistance, etc).

Time constraints can limit the number of variables chosen, so pick those most likely to work. If correlations are weak but show promise, then run another study to zero-in on the important variables.

Finding Part Quality/Process Data Correlations with the CoPilot System and The Hub Software (continued)

4. Know and Maintain the Process

RJG, Inc. recommends that a DECOUPLED MOLDING® process is used, whether DECOUPLED MOLDING® I, DECOUPLED MOLDING® II, or DECOUPLED MOLDING® III. It is also important to know if there is gate seal or gate discharge. Know the process and maintain it throughout the testing phase and beyond.

5. Determine Test Level and Number

Usually two test levels are sufficient: “Low” and “High”. A “Medium” level may be needed if the correlation is expected to not be a straight line (something with a “bow” in it), or just as an additional measure.

6. Machine Adjustment for In-Cavity Variable Adjustment

It is difficult or even impossible to adjust anything on the machine in order to affect only one plastic variable at a time.

Plastics Variables are interdependent in various degrees. For example, if fill time is increased, but the mold opens at the same time in the cycle, then it will result in decreased cooling time for the last area of the part to fill. Therefore, though it is not standard practice in Design of Experiments to change more than one variable at a time, it might be necessary to change two machine variables in order to effectively change just one plastics variable.

Beware of “orthogonal arrays” on machine variables, as it can result in changing all plastic variables on every run. Suppose flow rate was the variable to be changed; faster flow rates tend to fill the part farther due to compression. To achieve the same fill-only part, both fill speed and the V→P1 and V→P2 position (DECOUPLED MOLDING III) on the machine (or transfer position for DECOUPLED II) in order to change the flow rate—without affecting the pressurization portion of the cycle at the same time.

This concept applies particularly to transfer position (DECOUPLED MOLDING II) or slow-down position (DECOUPLED MOLDING III). When changing fill speeds, always go back to a short shot and make adjustments to the in-cavity position (by weight) to match the value discovered on shorts before changing the speed.

Another key objective is to not destroy the process by changing things that modify the essential elements of DECOUPLED MOLDING (if that is the process setup). Otherwise, if the process is excessively “coupled”, several or all plastics variables could be changing with change to one machine setting.

7. How Much to Change Each Value

Choose melt temperature and mold temperature based on manufacturer’s recommendations for molding, for final part quality (for eample, final part working temperature in semi-crystalline materials), or simulation. For variables such as flow rate and pressure, if unsure what limits to set, use the steps in “Sampling Parts to Make Correlation Data”, “6. Choose Process Limits” on page 117 set the limits. These are done once the process is running. Simulations can also be used to suggest limits.

8. Assign a Name to Each Sample Group

A sample “group” is a sample of parts with the same settings. For each chosen plastics variable (for example, mold temperature) there may be two groups, making four sample groups total, shown as follows:

- Group 1: pressure (high) at temperature 1
- Group 2: pressure (low) at temperature 1
- Group 3: pressure (high) at temperature 2
- Group 4: pressure (low) at temperature 2

It is useful to name the runs using the level and the variable, for example: “High P” for “High Pressure”, or “High P/Low T” for “High Pressure, Low Temperature”. It is common practice to write the number or letter on the physical parts and also keep a reference document that lists them.

9. Order the Group Samples By Execution of the Experiment

For example: It takes quite some time to change a melt temperature by adjusting the barrel temperatures. Try to do all pressure and flow group changes first, then change the melt and do pressure or flow at the lower temperature. This will save much more time than changing temperature at each group. Start with faster speeds, higher pressures. Start with lower temperatures. It takes longer to go down than up.

10. Determine the Number of Samples per Group Sample

It is beneficial to take extra samples for each group if the time is available (for example, fairly fast cycle times); all of the samples may not need to be measured, but the samples will be at hand if needed. For longer cycle times, take at least two to three samples in a group.

Finding Part Quality/Process Data Correlations with the CoPilot System and The Hub Software (continued)

Sampling Parts to Make Correlation Data

Before starting, ensure the following is/are in order:

- Decide how the parts will be labeled. Ensure that labeling does not interfere with the part characteristics or later measurements (markings obscuring a feature or deforming the part).
 - Collect supplies—markers, bags, tags, and other materials.
 - Plan part handling, especially with fast cycles and hot runners. Have a place for each group, and lay the bags out in order.
 - Plan to stabilize the parts after molding) in the way it will be done during production (cooling, or other processes).
1. Start the process using standard techniques (DECOUPLED MOLDING I, DECOUPLED MOLDING II, DECOUPLED MOLDING III, or other).
 2. Stabilize the process in fully-automatic.
 3. Set the fill volume on the CoPilot system at the slow-down to pack (DECOUPLED MOLDING III), or transfer (DECOUPLED MOLDING I).
This will provide accurate records for fill speed/flow rate and viscosity, as well as other variables.
 4. Choose the sensor and pressure level that represents a full cavity.
Usually, this is 1,000 psi at the end of the cavity, but if sensors are only at Post Gate or Mid Cavity, then change the sensor location and level as appropriate to create good data for cavity fill time and balance.
 5. Choose the sensor and percent of peak that represents a fully-packed cavity.
If all sensors are Post Gate, then the default Post Gate is acceptable. If sensors are Mid Cavity or End of Cavity, then change the sensor location as appropriate. If the pressure curves have very gradually rising tops lower the percentage for pack to ensure it does not pick up 98% at the wrong point.

6. Choose Process Limits

If not already chosen, determine the limits by adjusting the process as described below. This is only necessary if it is unknown how much variation the process can handle without becoming unstable or exceeding the capabilities of the machine. It is not necessary to use the maximum limits in order to get good correlation.

- A. Build a centered process that can withstand reasonable variation in the values chosen above.
- B. Save a template for the centered process.
This helps to ensure that the process is stabilized between runs.
- C. Change the settings until one or more of the following occurs:
 - Parts are visually unacceptable (short, flash, blush, etc.)
 - Anything causes cycle breaks, such as nozzle drool (mold protect), parts sticking, or difficulty ejecting.
 - Speeds or pressures exceed the machine's capability (for example, pressure limiting fill or pack), or the capability of any machines on which the process is expected to run.
 - The machine ceases to perform as instructed (for example, will not control speed or pressure, nozzle leaks).
 - The process is no longer robust (for example, not decoupled—fill is so fast that the flow front reaches the end of the cavity before slow-down) or stable due to low viscosity from slow fill rates.
- D. Choose levels just inside these limits to have the widest possible window for testing. However, from experience it may be known that certain values of cavity variables are unacceptable—if so, then narrow the limits accordingly.

- E. Record the chosen setting levels with each sample group as defined in "Planning a Part Quality Characteristic to Process Data Correlation Experiment", "7. How Much to Change Each Value" and "8. Assign a Name to Each Sample Group" on page 116. Record each limit for each control parameter (machine, temperature, V→P transfer etc.) that will be changing.
 - F. Return the process to the centered process and ensure that the data matches the template from "6. Choose Process Limits", "B. Save a template for the centered process." on page 117.
7. On the CoPilot system, perform the following:
- A. Create a note on the Summary Graph.
Include the purpose, equipment in use (machine, cooler, etc.), initial machine settings, and similar part sample settings.
 - B. Check for stability on the Summary Graph; effective viscosity/fill, cavity pressure integrals, mold temperature minimums, screw run time, cycle time, and average value/back pressure are useful data to check. The machine or auxiliaries can cause instabilities that can affect the results—look for trends or cycling in the data.
 - C. On the Part Sample widget, enter the name of the group (this would be the short name that you created in "Planning a Part Quality Characteristic to Process Data Correlation Experiment", "8. Assign a Name to Each Sample Group" on page 116). Enter details in the notes area.
 - D. Start the group sample. Do not save parts until instructed by the part sample widget. Always dump any accumulated parts until "Take Next Sample" is displayed. If the "Reject Samples" switch is on with a part diverter, then all sampled parts will go into the reject chute.

Finding Part Quality/Process Data Correlations with the CoPilot System and The Hub Software (continued)

- E. Do not press “Cancel Samples” unless the Part Sample widget was mistakenly started. Wait until all part samples are completed.
- 8. Bag, number, or label the sample parts in each group with the sample number and group name.
- ① **NOTE** *Do not stop the press between samples. It must run continuously to retain stability.*
- 9. Optionally, return the process to the centered process before changing settings for the next run. Check the template to ensure it matches the one saved in "Planning a Part Quality Characteristic to Process Data Correlation Experiment", "6. Choose Process Limits", "B. Save a template for the centered process." on page 117 to prevent changes that would affect the experiment.
- 10. Adjust the process for the next run, and repeat steps 7.C.–9. Repeat for each sample group.

Evaluate the Data

- 1. Record Part Sample Measurements
Measure the part samples and record the measurements in the part sample record on The Hub software (refer to "Enter Part Measurements" on page 45).
- 2. Find Correlations and Set Alarms
Refer to "Start a Correlation Study" on page 36.
- ① **NOTE** *If all of the measured parts fall within specification then the alarm limits can be set to the values of the in-cavity variables discovered in "Planning a Part Quality Characteristic to Process Data Correlation Experiment", "6. Choose Process Limits" when limits were set for the experiment.*
- 3. Adjust the Process
After alarms are set, adjust the process up and down to ensure that bad parts are sorted properly.

Choosing Alarm Settings with the CoPilot System and The Hub Software

Overview

The CoPilot system monitors process data using in-mold and machine sensors and machine sequence inputs. Alarms and sorting actions can be set for parts which fall outside of the alarm limits (high/above and low/below) in process data. The following describes alarms, alarm limits, and setting alarm limits to detect bad parts.

Choosing Alarms

The CoPilot calculates values using cycle data and sequence input information over time—called summary values—and displays them on the Summary Graph (the Summary Graph can display multiple summary values per sensor). The Summary values include a type category (for example, sequence time) and a location category (such as Fill time). Choose which summary values to set alarms on the CoPilot system.

1. Alarms for Quality Issues

Determine what types of quality issues to detect using alarms. Different cavity pressure values do a good job of checking for different quality issues. For example, “Peak, Cavity Pressure” works better for predicting flash, while “Process Time, Fill and Pack Time” (the time it took to fill and pack the part out) works better for predicting surface texture, especially in filled materials. To test whether or not a value predicts part quality, refer to “Finding Part Quality/Process Data Correlations with the CoPilot System and The Hub Software” on page 115.

Once the quality issues to be monitored are determined, use the tables in “Summary Values for Settings Alarms” on page 122 to choose the summary values on which to set alarms.

2. Quantity of Alarms

Determine critical to quality (CTQ) part characteristics and difficulty in maintaining part quality. In simple applications, only one set or more of alarms may be needed; in difficult applications, more alarms may be needed—as many as six or seven. To satisfy multiple quality issues (such as dimensions and texture), additional alarms will be needed. In general, minimize the number of alarms initially, then add more later if trouble catching problems persists. Using too many alarms can cause false alarms and confusion, especially if there is a lack of experience using alarms.

3. Alarm/Sensor Location

In general, the best place to monitor (set alarms) is at the end-of-cavity (this may not be true if a potential problem is far from the end-of-cavity).

In most cases, place the sensor in or near the area of influence. This is the area where the last material is flowing through the part at the end of the filling stage. To find the area of influence, run a clear or natural colored material, and then switch to a dark or colored material. On the first shot with the new material, the path that it makes will be the area of influence. Sometimes a sensor will not fit in that area; if not, get as close as possible to that area, and stay out of regions that stop flowing very early in the filling process.

If there are multiple sensors, it is okay to put alarms on all of the sensors.

Choosing Alarm Limits

The following are three different approaches on how to choose alarm levels.

- **Approach 1:** Estimate Alarm Limits Settings and Adjust as Necessary
 - How it works: Rough estimates are used at process start, and then refined during normal production.
 - Advantages: This is the simplest approach for setting alarm limits.
 - Disadvantages: This may be the slowest, least-accurate approach, unless it is used in conjunction with approaches 2 or 3.
- **Approach 2:** Alarm Limits for When Parts May Be Different than Before
 - How it Works: A stable process is chosen, and alarm limits are set to activate when the process changes significantly.
 - Advantages: This approach keeps process capability high.
 - Disadvantages: This approach does not sort good parts from bad.
- **Approach 3:** Alarm Limits When the Parts are Probably Bad
 - How it Works: An experiment is ran to determine what alarm levels will sort good/bad parts.
 - Advantages: This approach prevents bad parts from being shipped.
 - Disadvantages: This approach does not catch process shifts until bad parts are being produced.

Finding Alarm Settings with the CoPilot System and The Hub Software (continued)

Approach 1: Estimate Alarm Settings and Adjust as Necessary

Establish preliminary rough estimates of alarm limits and refine them during normal production. This approach does not allow alarms to be quickly stable unless either Approaches #2 or #3 are used in conjunction. Otherwise, it will take a while before alarms are optimized. During production, monitor parts that are rejected and adjust the alarms according to the analysis of the parts.

Perform the following steps:

1. Establish Preliminary Alarm Limits

Set preliminary alarms on each summary value; choose arbitrary alarm values. Generally, it is better to set the alarms tight and gradually loosen them than to set them loose and gradually tighten them.

2. Monitor Alarm Parts During Production

Periodically check the Reject bin for alarm parts. When parts are found in the Reject bin, inspect them (either all or a relatively large sampling).

Determine which summary values caused the alarms—these summary values are the ones that will be changed—use the following to adjust alarms:

- If none of the parts are bad, widen the alarms that were triggered the most.
- If a few of the parts are bad, widen the alarms that were triggered.
- If many of the parts are bad, tighten all the alarms slightly.
- If most of the parts are bad, tighten all the alarms considerably.
- If the result is somewhere between few and many bad parts, do not change the alarms.

Any time bad parts get into the Good bin, tighten all the alarms.

- If a few bad parts get into the good parts bin, tighten the alarms slightly.
- If many bad parts get into the good parts bin, tighten the alarms considerably.

Keep adjusting the alarms until few alarm parts are bad, and no bad parts get into the good parts bin. Ideally, no bad parts are sorted into the good parts bin, even if a few good parts are sorted into the bad parts bin.

Approach 2: Alarm Limits for When Parts may be Different than Before

A stable process is chosen, and alarm limits are set to activate when the process changes significantly. This approach keeps process capability high, but does not sort good parts from bad.

Perform the following steps:

1. Select Data from a Stable Process

Allow the process to stabilize; in most cases, this will take anywhere from 15 minutes to 1 hour. Watch the summary graph to see when stabilization occurs. Let the process run until there are at least 100 or more datapoints. There must not be any “outlying” datapoints—anything that is above or below the normal process.

Zoom in on the data in the stable region.

2. Set an Alarm on the First Summary Value

Choose the first summary value to set an alarm on (refer to “Summary Values for Settings Alarms” on page 122). Open the Alarm Settings widget on the CoPilot system, and follow the instructions found in the CoPilot System Software User Guide to set alarms using sigma. The Alarm Setting widget automatically defaults to 4.5σ (sigma), but can be changed.

3. Repeat for Each Summary Value to Set Alarms On

Set alarms to catch any parts when the process changes considerably from normal range. To catch any small variations, set alarms with a smaller window to $\pm 3\sigma$.

Finding Alarm Settings with the CoPilot System and The Hub Software (continued)

Approach 3: Alarm Limits When the Parts are Probably Bad

1. Plan the Experiment

NOTE *Select one quality characteristic to focus the experiment on, and only two or three cavity pressure values.*

Determine which machine setting will have the largest effect on the quality of the part (for example, part measurements). In many cases, this is hold pressure. This the 'experimental factor'; other common factors include fill speed, mold temperature, or melt temperature.

Determine which summary values to use for alarms (refer to "Summary Values for Settings Alarms" on page 122).

2. Run the Experiment

With the process running stably, adjust the experimental factor (machine setting) until the parts are no longer acceptable.

Observe and record the values for the cavity pressure values that will be used for alarms; these values will be the lower alarm points.

Repeat the previous step, but adjust the experimental factor in the opposite direction. Observe and record the values for the cavity pressure values that will be used for alarms; these values will be the upper alarm points.

3. Enter Alarm Settings into the CoPilot System Software.

The alarms should be conservative—a little tighter than the initial alarm points. Bring each of the alarm points in about 1/3 of the way to the centered process. While a few good parts may still get to the bad parts bin, be sure that no bad parts make it into the good parts bin.

Follow the instructions for entering alarm settings described in detail in Approach 1; the only difference being that the high and low alarm settings are entered manually.

Following this approach, alarms will reject parts that are likely bad, but the alarms are likely conservative. Some good parts may be sent the the bad parts bin, but no bad parts will enter the good parts bin.

Optionally, once alarms are set, verify the parts by adjusting the process until alarms occur on the high and low ends. Check/measure/inspect the parts to verify how close the desired dimensions/other characteristics are to the specification limit.

NOTE *This is the simplified approach to setting alarms. RJG, Inc. offers in-depth classes for systematic injection molding including molding strategies, design strategies, part troubleshooting, and process & production management.*

Setting Alarm Limits

Refer to the CoPilot System Software User Guide for instructions on setting alarms in the CoPilot system software.

Finding Alarm Settings with the CoPilot System and The Hub Software (continued)

Summary Values for Settings Alarms

Once the quality issues to be monitored are determined, use the following tables to choose the summary values on which to set alarms. Each table contains values to use for cavity pressure (preferred) and hydraulic and stroke (if cavity pressure is not available). The summary values are ranked in order of preference in each table (first listed is usually the best at predicting part quality).

Detecting Short Shots

Cavity Pressure	Hydraulic and Stroke
<ul style="list-style-type: none">• Peak, EOC (low alarm)• Peak, PG• Peak, MID• Cycle Integral, EOC (low alarm)• Cycle Integral, PG• Cycle Integral, MID• Fill and Pack Time (high alarm)	<ul style="list-style-type: none">• Peak, Shot Volume ($\pm 6 \sigma$)• Cycle Integral, Shot Volume ($\pm 6 \sigma$)• Effective Viscosity, Fill (high alarm)

Detecting Sinks

Cavity Pressure	Hydraulic and Stroke
<ul style="list-style-type: none">• Peak, EOC (low alarm)• Cycle Integral, EOC (low alarm)• Cycle Integral, PG• Fill and Pack Time (high alarm)	<ul style="list-style-type: none">• Peak, Shot Volume ($\pm 6 \sigma$)• Cycle Integral, Shot Volume ($\pm 6 \sigma$)• Effective Viscosity, Fill (high alarm)

Detecting Flash

Cavity Pressure	Hydraulic and Stroke
<ul style="list-style-type: none">• Peak, Any Cavity Sensor• Fill and Pack Time (low alarm)	<ul style="list-style-type: none">• Peak, Shot Volume ($\pm 6 \sigma$)• Cycle Integral, Shot Volume ($\pm 6 \sigma$)• Effective Viscosity, Fill (low alarm)

Detecting Texture

Cavity Pressure	Hydraulic and Stroke
<ul style="list-style-type: none">• Fill and Pack Time (low alarm)• Pack Rate• Cavity Fill Time• Peak, Any Cavity Sensor	<ul style="list-style-type: none">• Value at Fill→Pack Transfer, Volume• Value at Pack→Hold Transfer, Volume• Effective Viscosity, Fill• Peak, Shot Volume ($\pm 6 \sigma$)• Cycle Integral, Shot Volume ($\pm 6 \sigma$)

Detecting Dimensions

Cavity Pressure	Hydraulic and Stroke
<ul style="list-style-type: none">• Cycle Integral, EOC• Cycle Integral, PG• Peak, Cavity Pressure• Injection Integral, Cavity Pressure	<ul style="list-style-type: none">• Peak, Shot Volume ($\pm 6 \sigma$)• Cycle Integral, Shot Volume ($\pm 6 \sigma$)• Effective Viscosity, Fill (high alarm)• Peak, Hydraulic Injection• Value at Pack→Hold Transfer, Injection Pressure• Value at Fill→Pack Transfer, Injection Pressure or Shot Volume

Detecting Check Ring Leakage

Cavity Pressure	Hydraulic and Stroke
<ul style="list-style-type: none">• Process Time, Cavity Fill• Fill and Pack Time (high alarm)	<ul style="list-style-type: none">• Peak, Shot Volume• Cycle Integral, Shot Volume

Detecting Thin Wall Part Characteristics (other than texture)

Cavity Pressure	Hydraulic and Stroke
<ul style="list-style-type: none">• Fill and Pack Integral, EOC• Fill and Pack Integral, other Cavity Pressure• Peak, EOC• Fill and Pack Time	<ul style="list-style-type: none">• Peak, Shot Volume ($\pm 6 \sigma$)• Effective Viscosity, Fill• Fill and Pack Integral, Shot Volume ($\pm 6 \sigma$)• Value at Pack→Hold Transfer, Injection Pressure or Shot Volume• Value at Fill→Pack Transfer, Injection Pressure or Shot Volume

Detecting Stresses and Molecular Orientation

Cavity Pressure	Hydraulic and Stroke
<ul style="list-style-type: none">• Fill and Pack Time• Cavity Fill Time• Fill Shear Rate at Transfer• Static or Dynamic Pressure Loss, PG to EOC• Static or Dynamic Pressure Loss, Injection to PG	<ul style="list-style-type: none">• Fill Time• Value at Pack→Hold Transfer, Shot Volume

Finding Alarm Settings with the CoPilot System and The Hub Software (continued)

Detecting Blocked Cavities		Detecting Warp		Detecting Machine Operation Consistency	
Cavity Pressure	Hydraulic and Stroke	Cavity Pressure	Hydraulic and Stroke	Cavity Pressure	Hydraulic and Stroke
<ul style="list-style-type: none">• Range, PG Peak• Range, EOC Peak• Cavity Fill Time	<ul style="list-style-type: none">• Peak, Shot Volume ($\pm 6 \sigma$)• Cycle Integral, Shot Volume	<ul style="list-style-type: none">• Cooling Rate, any Cavity Sensor• Gate Seal, PG• Static or Dynamic Pressure Loss, PG to EOC• Fill and Pack Time• Cavity Fill Time	<ul style="list-style-type: none">• Fill Time• Pack Time• Injection Forward Time	<ul style="list-style-type: none">• Not Applicable	<ul style="list-style-type: none">• Fill Time• Cycle Time
Detecting Mold Balance		Detecting Mixing Consistency		Detecting Setup Consistency	
Cavity Pressure	Hydraulic and Stroke	Cavity Pressure	Hydraulic and Stroke	Cavity Pressure	Hydraulic and Stroke
<ul style="list-style-type: none">• Balance, Cavity Fill Time• Balance, Cavity Pack Time• Balance, EOC• Balance, other Cavity Peak	<ul style="list-style-type: none">• Not Applicable	<ul style="list-style-type: none">• Not Applicable	<ul style="list-style-type: none">• Average Value, Back Pressure• Screw Run Time	<ul style="list-style-type: none">• Cycle Integral, any Cavity Sensor	<ul style="list-style-type: none">• Fill Time• Injection Forward Time• Cycle Time• Screw Run Time• Value at Fill→Pack Transfer, Volume• Average Value, Hold Pressure• Average Value, Back Pressure• Average Value, Fill Flow Rate• Average Value, Pack Flow Rate• Decompression, Shot Volume
Detecting Crystallinity		Detecting Viscosity Changes			
Cavity Pressure	Hydraulic and Stroke	Cavity Pressure	Hydraulic and Stroke		
<ul style="list-style-type: none">• Cooling Rate, any Cavity Sensor• Cycle Integral, any Cavity Sensor	<ul style="list-style-type: none">• Average Value, Mold Surface Temperature	<ul style="list-style-type: none">• Static or Dynamic Pressure Loss, PG to EOC• Static or Dynamic Pressure Loss, Injection to PG• Value at Fill→Pack Transfer, PG	<ul style="list-style-type: none">• Effective Viscosity, Fill• Screw Run Time		
Detecting Core Deflection		Detecting Gate Seal			
Cavity Pressure	Hydraulic and Stroke	Cavity Pressure	Hydraulic and Stroke		
<ul style="list-style-type: none">• Peak, Core Deflection• Cycle Integral, Core Deflection	<ul style="list-style-type: none">• Effective Viscosity, Fill• Fill Time	<ul style="list-style-type: none">• Gate Seal, PG	<ul style="list-style-type: none">• Injection Forward Time		

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