



SURFACE VEHICLE RECOMMENDED PRACTICE

J2892™

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Graphics-Based Service Information

RATIONALE

SAE J2892 has been revised by the Graphics-Based Service Information Committee to include minor wording edits and add new symbols.

1. SCOPE

This document establishes standard graphical symbols and color conventions for use in either still (static) or animated graphics used for communicating service information. This document's purpose is to communicate conventions for using those symbols and colors to accurately and consistently communicate intended information via graphics-based documentation. These practices are intended for use in service procedures, assembly instructions, training materials, and similar applications when trying to minimize the amount of human natural language text used within the document. The still and animated graphical conventions referenced should support effective communication via paper and "traditional" electronic media. The conventions can also extend to documenting via additional electronic delivery paradigms such as augmented reality (AR).

This document is intended for organizations interested in using graphics-based documentation to record and communicate assembly, adjustment, maintenance, and other service procedures.

Adoption of this document's recommendations involves a series of business decisions. An organization choosing to follow this recommended practice is able to decide to implement the entire set of recommendations or to selectively adopt only those recommendations it determines are appropriate for their unique needs and situation. Short- and long-term retention of an organization's legacy symbols and conventions are options to consider. Implementation may be partial or progress through multiple stages towards the full set of recommendations. In all situations, realizing this document's maximum, long-term benefits for all companies, organizations, and people requires that the symbols, colors, and conventions recommended be widely taught and applied.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 ASD-STAN Publications

Available from ASD-STAN Secretariat, Rue Montoyer, 10/5, B-1000 Brussels, Belgium, Tel: +32 2 775 81 26, www.asd-stan.org.

S1000D International Specification for Technical Publications Utilizing a Common Source Database

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SAE WEB ADDRESS:

Full document details: SAE J2892_202111

For more information on this standard, visit
https://www.sae.org/standards/content/J2892_202111

Documents

Document Sharing Hub

2.1.2 IEC Publications

Available from IEC Central Office, 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland, Tel: +41 22 919 02 11, www.iec.ch.

- IEC 80416-1 Basic Principles for Graphical Symbols for Use on Equipment - Part 1: Creation of Symbol Originals
- IEC 80416-3 Basic Principles for Graphical Symbols for Use on Equipment - Part 3: Guidelines for the Application of Graphical Symbols
- IEC 60417 Graphical Symbols for Use on Equipment
[IEC 60417 is only available via subscription in database form at <http://www.graphical-symbols.info/>]

2.1.3 ISO Standards

Copies of these documents are available online at <http://webstore.ansi.org/>.

- ISO 3864-1 Graphical Symbols - Safety Colors and Safety Signs - Part 1: Design Principles for Safety Signs and Safety Markings
- ISO 7000 Graphical Symbols for Use on Equipment - Registered Symbols
[ISO 7000 is available via subscription in database form at <http://www.graphical-symbols.info/>]
[Symbols are available in the ISO online browsing platform at <https://www.iso.org/obp/ui/>]
- ISO 7001 Graphical Symbols - Public Information Symbols
[Symbols are available in the ISO online browsing platform at <https://www.iso.org/obp/ui/>]
- ISO 80416-2 Basic Principles for Graphical Symbols for Use on Equipment - Part 2: Form and Use of Arrows
- ISO 80416-4 Basic Principles for Graphical Symbols for Use on Equipment - Part 4: Guidelines for the Adaptation of Graphical Symbols for Use on Screens and Displays (Icons)

3. DEFINITIONS

3.1 AMBER

A color that is a combination of red, yellow, and black. This color is part of the ASD-STAN S1000D color pallet. See Figure 1.

3.2 AUGMENTED REALITY

Information projected into a person's view of the physical world. The information is either text or graphics and is normally associated with physical objects and its projected orientation and scale are controlled in real-time by the using person's and viewing device's relative position and orientation with those physical objects.

3.3 BLACK

A color that is the result of not emitting or reflecting light in any part of visible light. This color is part of the ASD-STAN S1000D color pallet. See Figure 1.

3.4 BLINK

Causing a part or visualization to rapidly switch one or more times between being visible and invisible.

3.5 BLUE

A primary color that is generally similar to the appearance of a clear sky. This color is part of the ASD-STAN S1000D color pallet. See Figure 1.

3.6 BLUE/WHITE DASH

Alternating blue and white bands. See Figure 1.

3.7 BUBBLE

A circle, square, or other outline used to encompass a part, feature, or group of objects for the purpose of drawing attention to the objects in their interior.

3.8 CALLOUT

Alpha or numeric identifiers used with accompanying steps, tables, or text. Callouts are frequently used to indicate sequence of operation and to associate a specification and other information with a part.

3.9 COLOR

Color is the visual perception in humans of the presence of varying percentages of red, green, and blue in reflected or emitted light. Use the ASD-STAN S1000D pallet, as defined in that document's chapter 3.9.2.2.1, for generating the majority of the colors named in this document. See Figure 1.

3.10 CYAN

A greenish-blue color, it is midway between blue and green, making it the complementary color to red. This color is part of the ASD-STAN S1000D color pallet. See Figure 1.

3.11 FLASH

Causing a part or visualization to rapidly switch four or more times between two different appearances

3.12 GREEN

A color between blue and yellow. This color is part of the ASD-STAN S1000D color pallet. See Figure 1.

3.13 ICON

A small graphical symbol used on computer displays and printed pages the meaning of which is often interpreted through its resemblance to physical objects.

3.14 LEADER LINE

A thin line, frequently with an arrow head, and oriented at an angle to tie information to a part or feature.

3.15 LIGHT BLUE

A color that is generally similar to the appearance of a clear sky. This color is part of the ASD-STAN S1000D color pallet. See Figure 1.

3.16 LIGHT GREY

A neutral color between black and white. This color is part of the ASD-STAN S1000D color pallet. See Figure 1.

3.17 MAGENTA

A color that is deep purplish red that is the complementary color of green and, with yellow and cyan, forms a set of subtractive primary colors. This color is part of the ASD-STAN S1000D color pallet. See Figure 1.

3.18 MULTIPLE

Having more than one part resulting in an act occurring more than once. For example: Removing the five cap-screws attaching a wheel rim to the wheel hub.

3.19 ONE COLOR PRINTING

Printing using one color of ink on paper; normally black ink on white paper.

3.20 PATTERNING

A repetitious patterned fill, such as alternating color squares, stripes or others, to the interior of one or more parts in 2D illustration or applying the same to the exterior skin of a 3D visualization of the same.

3.21 PROCEDURE COMPONENTS

Subdivisions of a procedure: title, table of contents, index of messages, graphic symbols glossary, special tools used, list of procedure steps, procedure steps, references, and ending.

3.22 PURPLE

A mixture of blue and red. This color is not part of the ASD-STAN S1000D color pallet. See Figure 1.

3.23 RED

A primary color that is generally similar to the appearance of a ruby. This color is part of the ASD-STAN S1000D color pallet. See Figure 1.

3.24 REPETITION

The act of repeating the performance of an action, process or step more than once. For example: turn a cap-screw in a clockwise direction for three complete rotations.

3.25 RGB

An additive color model in which red, green, and blue light are added together in various ways to reproduce a broad array of colors. The name of the model comes from the initials of the three additive primary colors: red, green, and blue.

3.26 SPECIAL TOOL

A unique tool needed to perform a service action on a product.

3.27 WHITE

A mixture of all colors. This color is part of the ASD-STAN S1000D color pallet. See Figure 1.

3.28 YELLOW

A color that is generally similar to the appearance of ripe lemons and, with magenta and cyan, forms a set of subtractive primary colors. This color is part of the ASD-STAN S1000D color pallet. See Figure 1.

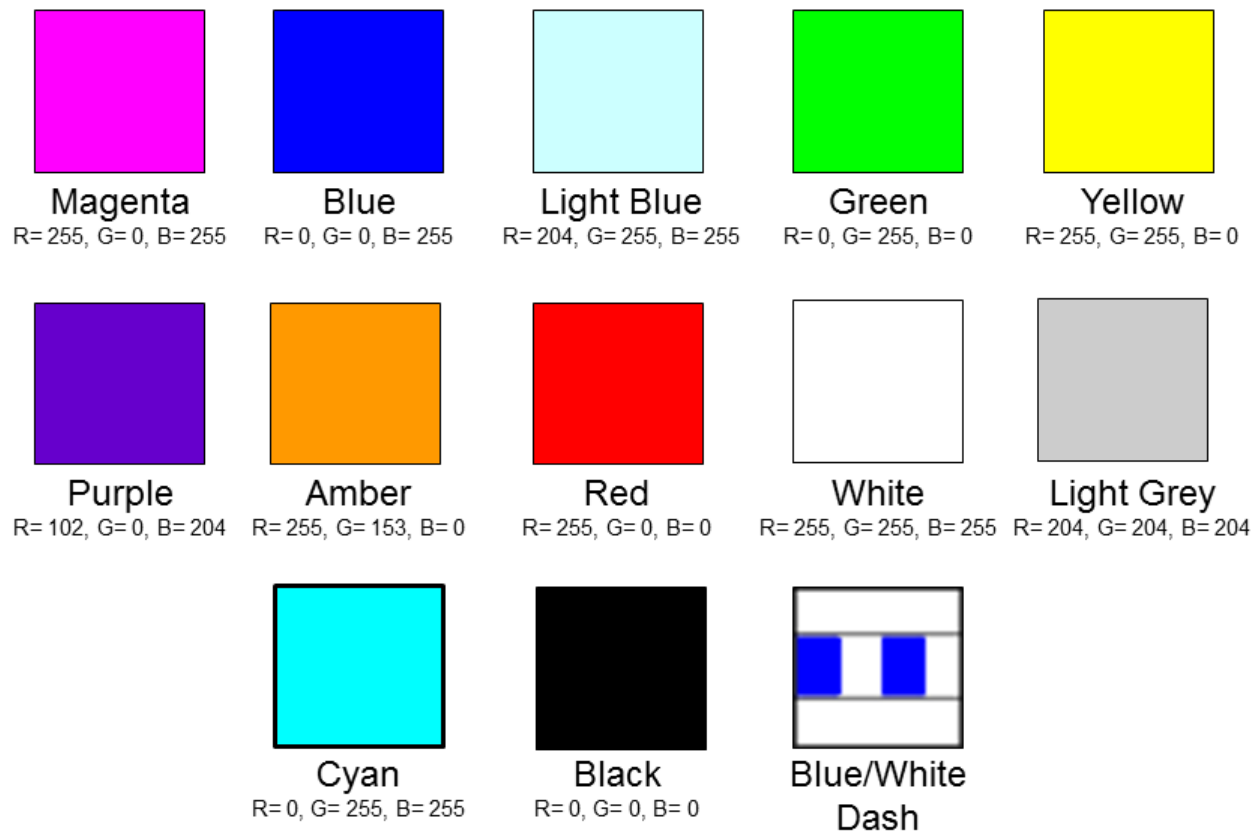


Figure 1 - Recommended color pallet

4. METHODS TO COMMUNICATE A SERVICE ACTION

With increasing globalization of service literature, translation efforts significantly impact project budgets and timelines. Graphics and standardized symbols become viable tools for reducing translation workload. Graphics and standardized symbols are generally deemed to be more quickly understood and clearer than text for most readers. Text is required when an action cannot be adequately and clearly communicated by a graphic alone.

General guidelines for work action authoring:

- The best work action communication method is usually a graphic.
- Graphics depicting or supporting the work action should be the default method.
- Standardized graphical symbols and color can be added within the graphic or nearby to communicate simple common tasks (e.g., move, inflate, and tighten).
- Text should be added only when a graphic and a standardized symbol does not fully communicate the work action.
- Adding text with a graphic should be done only when necessary to explain critical details, special techniques, or other non-intuitive work actions.
- Textual content should be saved and reused to reduce future translation costs.
- Avoid using specific details such as component names or unique qualifiers. For example, "Inspect the component for corrosion" supports greater reuse, and therefore lower translation costs, than "Inspect the brake rotor for corrosion."

- Keep sentences short to promote reuse.
- Reuse existing sentences rather than create similar but textually different work instructions that cause additional translation time and money. For example, reuse "Remove bolts and slide rotor off of bearing hub" rather than create a new sentence: "Remove five bolts and slide brake rotor off of bearing hub."

5. TECHNICAL RECOMMENDATIONS

5.1 General Appearance

Strive for consistency in the look and feel of work instructions by applying the same sequence, pace, general layout of information displays, application of colors, standard graphical symbols, messages, and graphic conventions to every work instruction.

Consistency is important because it improves user comprehension. An inconsistent document creates confusion about the meaning of the graphical symbols.

Assign a sequential number to every logical step and illustration within an overall procedure. Use a consistent and unique combination of location, font and format properties for the step numbers.

5.2 Procedure Sequence

The following sequence of procedure components should be used:

5.2.1 Title

Beginning the procedure with its title enables the user to confirm they are viewing the information they need to understand.

5.2.2 Table of Contents (Optional)

Including a table of contents in the procedure facilitates the user's rapid navigation of the information if the procedure has three or more of this section's component parts or the documentation is animated.

5.2.3 Index of Messages (Optional)

Including a sequential list of all text based messages and specifications within the procedure facilitates the user's rapid access to the information and can provide an experienced user all they need to know for properly performing the task.

5.2.4 Graphic Symbols and Color Glossary

A symbols dictionary or glossary is a critical element of any technical document that uses graphic symbols. If a comprehensive dictionary of all graphic symbols used within all procedures is readily available to the user, a glossary of graphic symbols used within the procedure may be eliminated.

A color glossary or key is also a critical element of graphic-based technical documentation when colors have specific meanings. See 6.1. If documentation uses color and a comprehensive color glossary of all colors used within all procedures is readily available to the user, an explanation within the procedure may be eliminated.

Electronic delivery media can support the pop-up display of a symbol's meaning upon moving the cursor over the symbol.

5.2.5 Tools Used

A list of tools at the beginning of the procedure helps the user to prepare for the prescribed service action.

5.2.6 List of Procedure Steps (Optional)

For paper and paper-like electronic media, including a table of contents is normally sufficient and avoids possible subversion of the prescribed method. For animations and interactive electronic media, including a list of the steps in logical sequence within the procedure facilitates rapid navigation to each step. To facilitate simple and quick access for multiple viewings of animations, a hyperlink should be included from every step in the list to the start of the associated animation sequence.

5.2.7 Procedure Steps

Documenting the steps required to complete the procedure using the graphical symbols and conventions described in this document should enable the user to clearly understand the work instructions and to accurately complete the job in a safe and efficient manner.

5.2.8 Illustrations

Step illustrations should convey the location of the target component while remaining as focused on the task as possible.

The first graphic used to support the task, such as the removal of a component, should also be illustrated to emphasize the component's location and the machine's orientation. Subsequent graphics should avoid excessive details which either distract from the target component or limit reuse in other products.

5.2.9 References (Optional)

If references are made within the procedure to one or more specifications, procedure stories, and other documentation, including a list of those references facilitates the user's ability to locate and use them. For electronically delivered documentation, include a hyperlink to each reference within the list. Output styling for print versions of the procedure should add text with the procedure title and location.

5.2.10 End

Indicating when the procedure and its story are complete enables the user to determine when their work is done.

5.3 Story Pace

Allow two to three seconds of time for viewing of each graphical symbol, sub-step, and message in an animated procedure. This pace presents the information to the user at a rate that is comparable to reading traditional, text-based documentation.

5.4 General Layout

Develop specifications for the general appearance and layout of each type of procedure component used. The user should always be able to identify the type of procedure component being viewed. If a procedure component needs to display several types of information—such as a graphic, specification, and step number—assign each information type its own consistent location on the page or display.

Best practice is to use a standard structured markup language to define procedure structure, components required, and structure. Standards such as eXtensible Markup Language (XML), Standard Generalized Markup Language (SGML), and others enable control and enforcement of component usage and procedure organization.

Numbering steps within a procedure facilitates communication by the documentation's users with the document's authors and subject matter experts. Locate all step numbers in the same location next to or within every illustration of the procedure. Locating step numbers outside of illustrations facilitates reuse of the illustrations.

Step order can be defined by callouts in an illustration. Use a consistent illustration layer, which is easily modified for reuse. Placing related step order instructions in adjoining text keeps text out of graphics. If a step number needs to be included in a graphic, use a consistent illustration layer which can be easily modified or ignored for reuse.

5.5 Useful Words and Their Graphical Symbols

Consistently use standard graphical symbols to clearly communicate tasks and concepts. Substituting standard graphical symbols for words maintains the clarity of the documentation's message while reducing the number of words to be translated.

See Section 7 for the list of recommended standard graphical symbols and a list of symbols under consideration for future recommendation.

When symbols are placed in graphics, use a consistent illustration layer which is easily modified for reuse of the illustration. Symbols should have white-space around them for visibility. White-space is especially important with 3D visualizations because the documentation user can move or rotate their point of view, possibly placing a symbol in-front of the product.

Symbol modifiers, such as arrows, callouts, leaders, and specifications may encroach on a symbol's white-space. See Figure 14.

5.6 Messages

When text is used within procedures it is important that its purpose is clear and quickly understood by readers. Because messages can be categorized into a limited number of types, identification of type can be assisted through the application of a consistent and unique appearance for each message type. Knowing the message type at the beginning of the reading process enables the user to quickly determine the general purpose of a message before the text is read.

Because people have different levels of visual acuity and different visual handicaps, such as color blindness, it is important that unique combinations of several formatting cues be used to identify each type of message. Bold versus normal, italics, font type, letter size, underlining, color, borders, graphical symbols, and more formatting features should be selected and grouped into distinct combinations for each message type.

6. GRAPHIC CONVENTIONS

Use of graphic conventions (color, patterning, leader lines, bubbles, and callouts) should call attention to and identify the parts involved in and to be acted upon during a procedure. Some techniques are well suited for use in animations and electronic displays while others are appropriate for use in still illustrations on printed paper pages.

Consider calling attention to the involved parts when there is a lot of clutter or detail being displayed and when multiple or small parts are to be acted upon. See Figure 2.

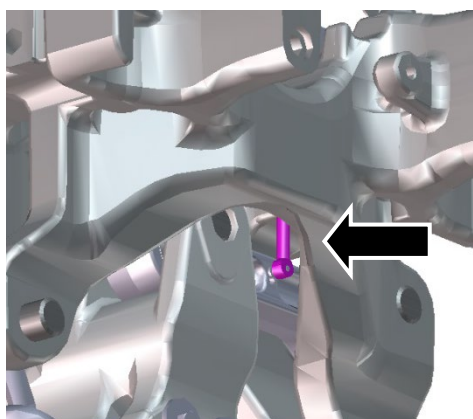


Figure 2 - Using magenta to call attention to a fastener

Call attention to all of the parts in a group that a uniform specification applies to. See Figure 3.

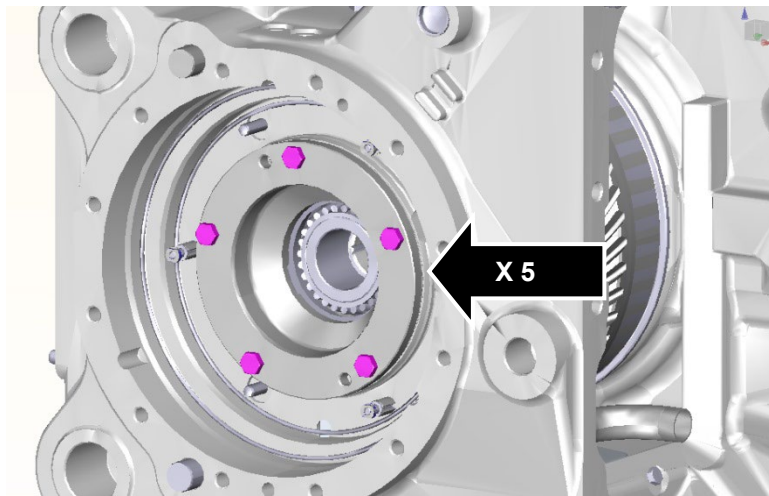


Figure 3 - Calling attention to a group of parts

6.1 Color

Illustrations in a manual can be used to replace written step instructions. Color-coding of targeted components or sections of a part can be used to communicate the required step action or actions. Related actions, such as a tightening a fastener or inspecting a part, can be communicated with small graphical symbols such as those featured in this document.

An example of a colorization scheme used to communicate a work action follows:

- Any fastener, retainer, or electrical connector to be removed or disconnected - **Magenta**
- The target or primary component to be removed - **Blue**
- Components to be removed for access to the target component - **Amber** or **Green**
- Components placed aside for access, but not removed; highlighted areas of adjustment, inspection, or special attention - **Yellow**
- Special tools or other equipment - **Cyan, Light Blue, or Purple**
- Surfaces where a chemical or material (e.g., sealer) is to be applied - **Blue/White Dash**
- Sectioned or cutaway surface - **Red**
- Remaining components - **Light Grey**
- Background - **White**

Figure 4 demonstrates the use of colors to communicate the actions required in a step to remove a turbocharger.

Two identical fasteners are removed, indicated by the x2 arrow. A third fastener of a different type is removed (the arrow calls attention to the fastener if a user is not be able to easily see the magenta color). Callouts are used to identify the fasteners as they can require different torques during installation; those two torque values would be listed in associated step text. The hose clamp is another fastener to be removed with its special torque. The yellow coloring of the hose indicates it is to be moved aside, but not removed.

These written steps would be necessary if the illustration did not have color coding:

1. Remove the engine oil pipe fastener at the engine connection.
2. Remove the two engine oil pipe fasteners from the turbocharger and remove the pipe.
3. Loosen the hose clamp.
4. Remove the air inlet hose from the turbocharger and position aside.

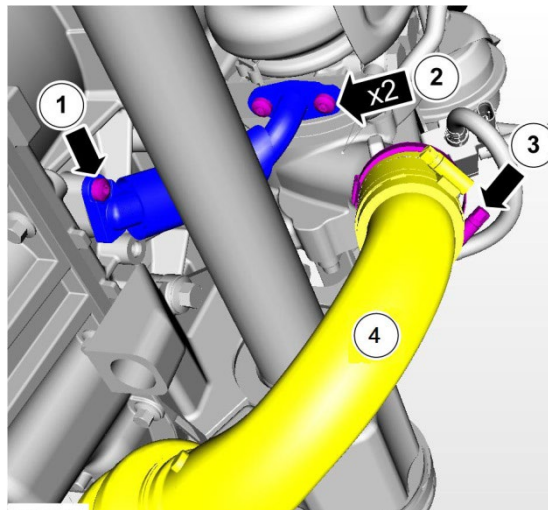


Figure 4 - Actions in a step to remove a turbocharger

Figure 5 uses these same colors to communicate the step required to remove an engine accessory drive belt. The belt tensioner is highlighted yellow because it is to receive the step action to remove tension from the blue target part (belt). The wrench is colored pale blue because it is used in an unusual manner to apply rotational force to the tensioner.

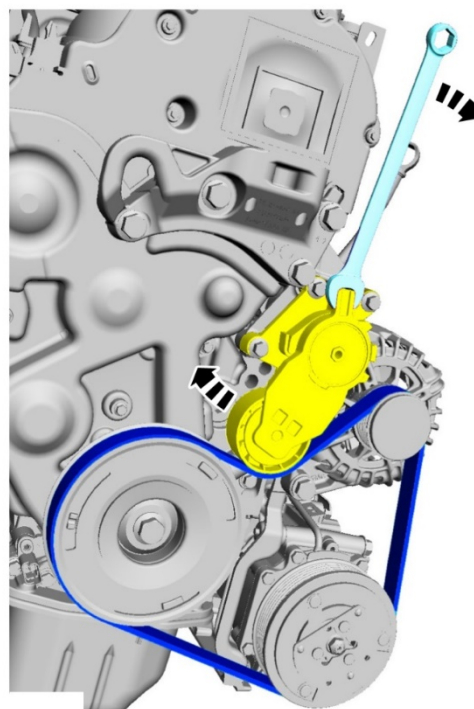


Figure 5 - Standard colors applied to tool, part acted upon and affected part

Color is the preferred display and printing choice for color-coded service documents. Today, the majority of service documents are delivered electronically or online using internet browsers. Online delivery supports critical updating of service information not possible with distributed media or printed documents.

Color-coded service documents may lose critical step action information if printed with a one color or grey-scale printer. If printing will primarily be in one color or grey-scale, an alternate version to mitigate the loss of color information should be considered. Using black and white fill patterns as a substitute for key color coding is recommended in these situations. Fill patterns must be easily identifiable and clearly delineate each type of intended service action. These can be incorporated into a separate document type to be used for printing in one color or grey-scale. It may be possible to automate “translation” of color graphics into the black and white fill patterns using software.

6.2 Arrows, Leader Lines, and Callouts

Callouts can be used to:

- Define sequences
- Identify components
- Differentiate similar or identical fasteners (e.g., different fastener lengths or different torque values)
- Associate a fastener with its appropriate torque value and other specification

Call attention to a location on one part when the work task involves inspecting the location. Use closed-head arrows to call attention the specific location of a part to be inspected. See Figure 6.

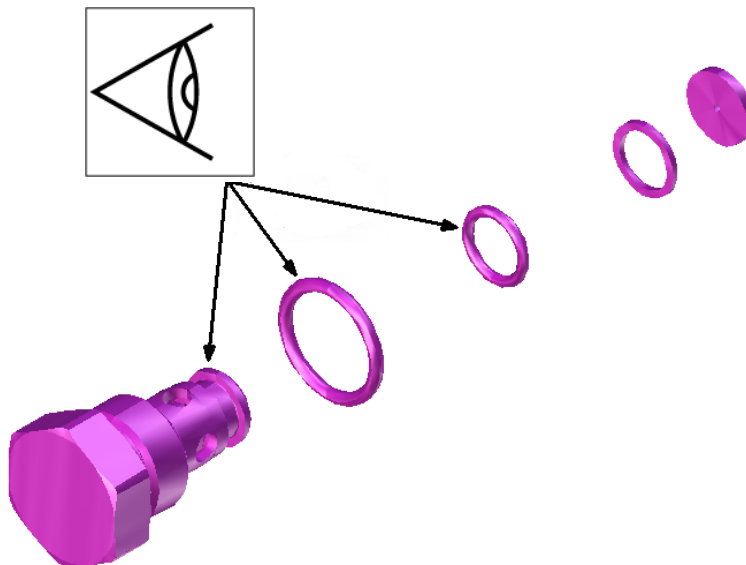


Figure 6 - Calling attention to an inspection

Include closed-head, black-filled arrows pointing from one part to the next for illustrating the required specific sequence.

Include closed-head, black with alternating black and white filled arrow-shafts pointing from a part and tool in the direction of intended motion. Arrow-shafts can be shaped to indicate the motion path the part or tool is to take. See Figure 7 for several examples of possible arrow-shaft shapes.

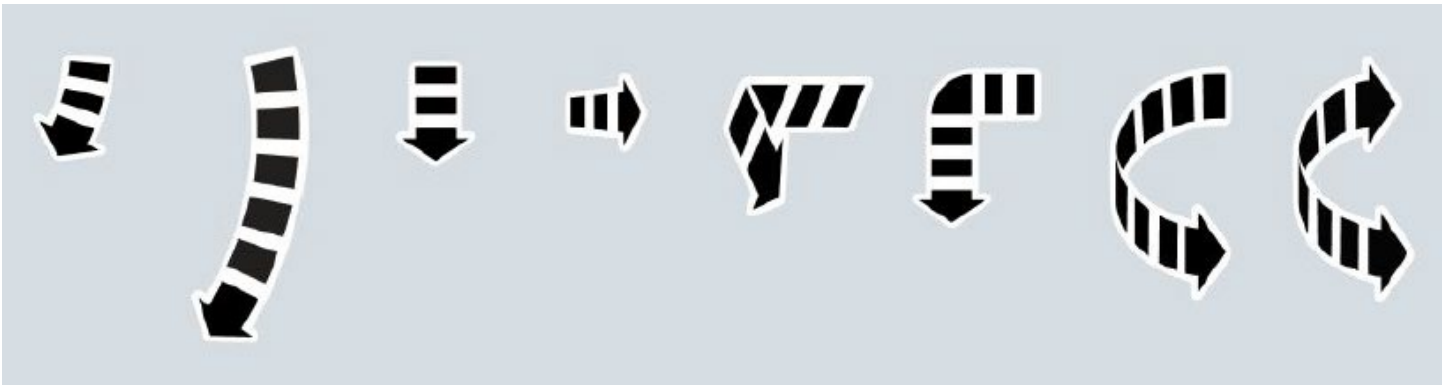


Figure 7 - Several movement arrow examples

Include leader lines with arrow heads to point to the location for applying adhesives, gaskets, and other materials and to call attention to specific locations or points to be inspected. Indicate surfaces where a chemical or material (e.g., sealer) is to be applied with a thick line with the alternating blue and white fill outlining the entire surface or perimeter(s) of the area to be covered. See Figure 8.

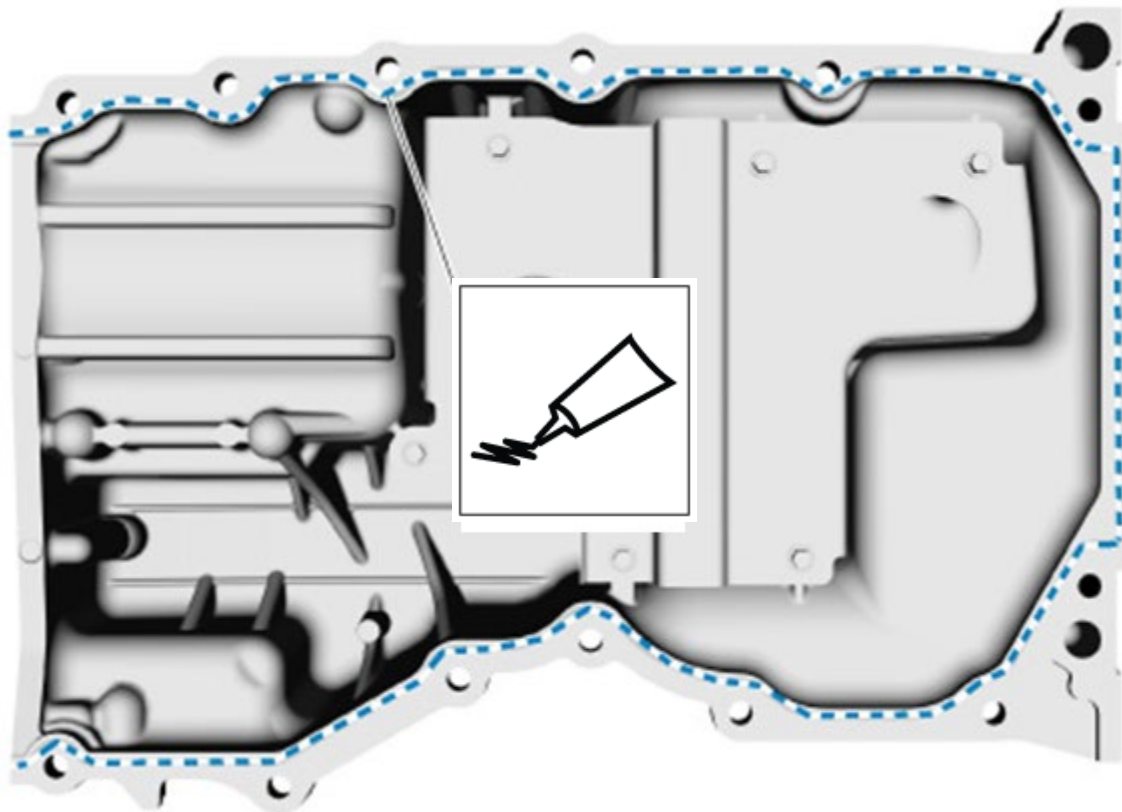


Figure 8 - Indicating where to apply a material