Engineering Changes

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CONTACT Software

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Contents

Introduction

Technical changes represent one of the most important processes in the product lifecycle. The challenge here is to provide reliable but flexible control of the change processes together with faster cycle times. The earlier and faster the necessary changes can be taken into account, the lower subsequent costs are likely to be. Changes must be reviewed by different groups, depending on the product group and the maturity of the product. Activities such as this can easily be mapped with *CONTACT Engineering Changes* and, where required, can even be adapted dynamically on the basis of rules.

Technical changes' influence on quality, costs and dates of delivery require a systematic planing, realization and documentation. *CONTACT Engineering Changes* offers you a flexible tool for digital, workflow-controlled processes. Clearly arranged change briefcases with the relevant parts, documents and models, along with the operation control, form the backbone of the accurate, digital change process.
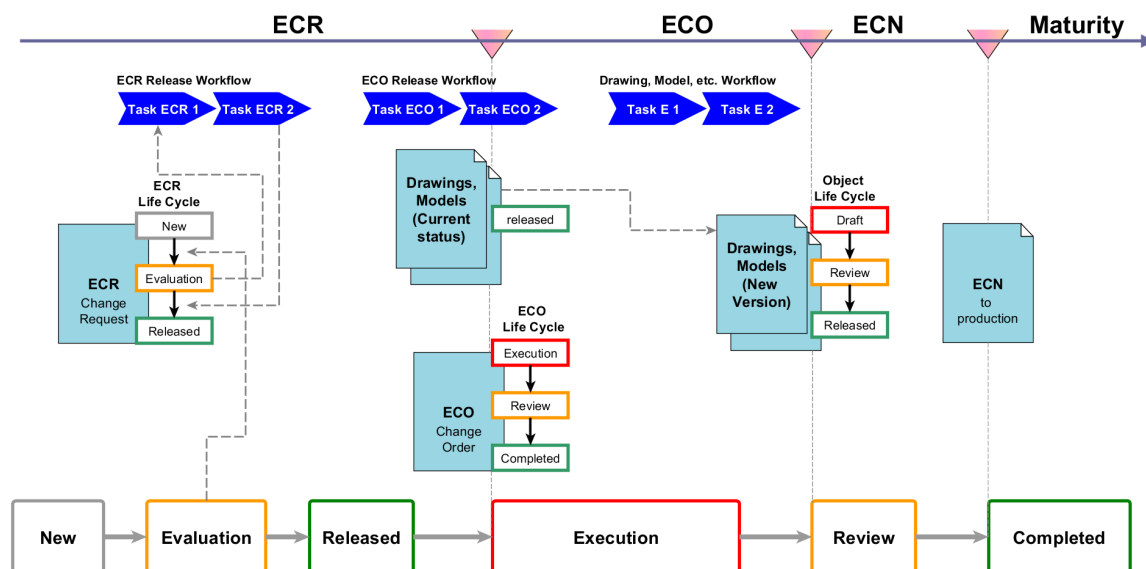
Fig. 1.1: Schema of the engineering process

1.1 Background and function

Changes to the product soon before the start of production or even during serial production are costly and associated with risks. Even in the early phases of product development, a systematic change process is often necessary to keep product costs under control, supply all participants with the up-to-date development status and ensure required QA measures.

To summarize, the planning, analysis and tracking of engineering changes is indispensable. They must be systematically documented and communicated if various processes are in progress simultaneously, such as design engineering, simulation, toolmaking, prototyping or production scheduling.

This brings up a number of questions: What CAD models are affected by a change? Have all departments and locations evaluated the change? Have the specified tests and trials been carried out? What were the results? Which development status was the last design review based on? Which status was the current tool design based on?

Engineering Change Management answers all of these questions. The relevant parts, documents and models, as well as the accompanying documentation, are available for direct access to all participants and compiled in a clearly arranged manner as a "virtual change briefcase". Therefore, you can guarantee that even extensive and complex changes can be carried out on time and with minimized costs while also taking product quality into consideration.

Functions

- Engineering Change Lifecycle: Request (ECR), Order (ECO) and Notification (ECN).

- Template management for various change scenarios: Fast Track, Standard etc., depending on the product maturity, for example.

- Direct access to the work objects changed or to be changed, such as parts, documents, and models.

- Significant acceleration compared to paper-based circulation procedures.

- High level of clarity due to briefcases for all relevant work objects, test results, modification notes, order documents and other accompanying documents, such as cost calculations.

- Automation and assistance, e.g. using automatic notifications or collective release of the relevant parts, documents and models.

- Ensuring consistency in a rule-based manner. Example: Completing all changes before full EC release.

1.2 Workflow of an EC

Engineering changes are managed via the *Engineering Change Management* module. To be able to better control, manage and check these sometimes very complex technical change processes, the life cycle of an engineering change is separated into 3 phases. The phases are based on the practical editing sequences: the ECR as change request, the ECO as change order and the ECN as concluding information.

ECR (Engineering Change Request): After creation, an engineering change is in phase ECR. As a change request, the engineering change contains the general application which lists all required information, such as motives, documents and suggestions for improvement. This phase of the EC is particularly important, since it is decided here whether implementing the product change is realistic and would be profitable. In these approval processes, the change applications or requests are usually checked and evaluated according to the criteria of costs, complexity or feasibility. Product maturity and product group are also influencing factors here. A positive evaluation and the status change to be carried out lead to the next phase ECO.

ECO (Engineering Change Order): After all *Workflows* of the ECR phase have been successfully closed, the engineering change automatically enters the processing phase ECO (For *Workflows*, see the user manual *Workflows*). In this phase, possible solutions for the engineering change are developed, designed, drawn, etc., then finished and submitted for testing. All problems that were listed in the ECR phase are taken into account and resolved. The changes and improvements that were made appear as documents and parts in new versions, collected in the "Virtual Change Briefcase", i.e. the engineering change in the last phase ECN.

ECN (Engineering Change Notification): The concluding phase ECN is reached, in turn, if all *Workflows* of the ECO phase to be executed were successfully closed and reviewed. For review, the business process for change approval is implemented as *Workflow*. If the change process is completed successfully, the documents and parts that came into being through the versioning replace the documents and parts that were brought in initially, which had their status changed to "Obsolete". Then all information is available to the users as a virtual change briefcase with all relevant information for the process.
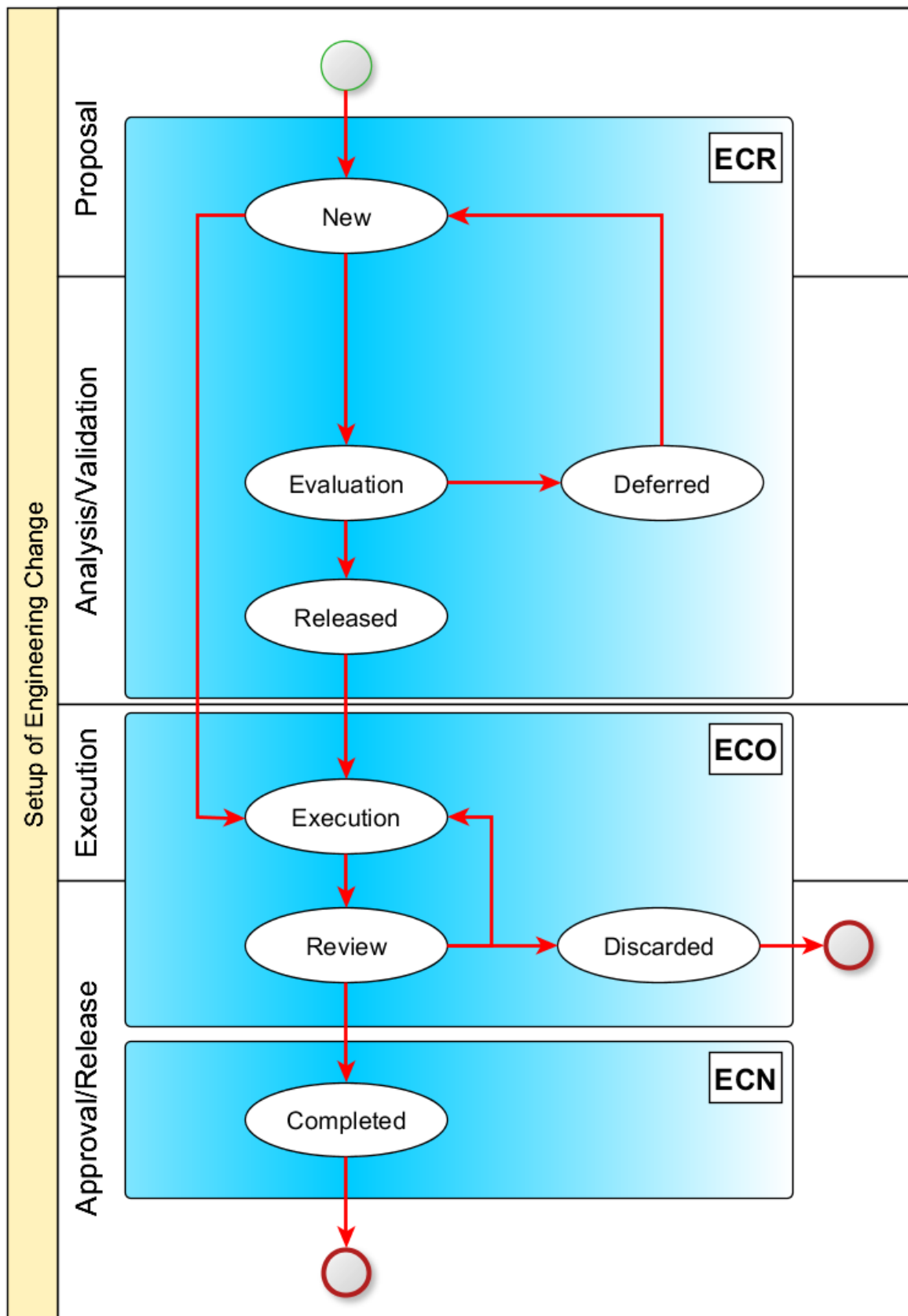
Fig. 1.2: Workflow of Engineering Change

The graphic shows that the EC phases can be run through in different ways. Depending on the complexity and maturity of the change projects, the editing sequences can also be changed. That is, targeted adaptation of the configuration of the ECM objects is possible in order to be able to cover the broadest possible range of use cases.

1.3 Example scenarios

The Engineering Change Management appears to the users as a "virtual change briefcase", in which all relevant information and documents are provided in the work statuses required for the change process. The following scenarios and application examples are intended to show that there is also a number of different processes based on the different engineering change templates and configuration options. Only a few items and documents are subjected to the change process in the scenarios as an example. The real change processes are far more complex and extensive and should also be supported in the manner shown here.

1.3.1 Scenario 1: Without approval and review

We are looking at the simplest case of an engineering change. Here, the product undergoes a change process without needing an approval to happen in the ECR phase or a review to happen in the ECO phase. Thus this EC template contains no *Workflows* and there are no *Tasks* needing to be evaluated. In *Workflow of Engineering Change* (page 3), the *New* status is changed to the *Execution* status directly, without the review steps. The validation and approval follow when the *Review* status changes to the *Completed* status. The individual documents and items are individually reviewed and, where appropriate, approved, unlike the check "in the block" via workflows, illustrated in the following scenarios. The ECR and ECO phases are executed in this case only in the simplest way.

This scenario always includes the following steps:

1. The engineering change is created in the ECR phase from a template (see *Work with engineering changes* (page 8)).

2. The work objects (approved models, drawings and accompanying documents) are linked to the engineering change (for example, as a drag-and-drop assignment, see *Adding accompanying documents, CAD documents and parts* (page 10)). The engineering change is changed to the *Execution* status via a status change.

3. In the ECO phase, new work versions of the documents and parts can be created by indexing the data (see *Indexing/changed CAD documents, changed parts* (page 10)). This introduces the actual change process, in which the designers and developers carry out the changes to the content.

4. With the status change from the *Review* status to the *Completed* status, we conclude the engineering change and take over the new version of the product. This is the ECN phase, that is, all information and objects that were affected by the change process are now documented by the engineering change notification object.

1.3.2 Scenario 2: Without approval, with review

In the second example, an engineering change is to be implemented without a review request and approval request, but with a final check. This engineering change template contains only one *Workflow* with multiple *Tasks* that have to be successfully closed to approve the engineering change. Looking at the *Workflow of Engineering Change* (page 3) figure, the *New* status is changed to the *Execution* status directly, without the review or approval steps. The ECR phase is only barely executed in this case.

This scenario always includes the following steps:

1. As in scenario 1, the engineering change is created in the ECR phase from a template, linked to the work objects to be changed, and then changed to the *Execution* status.

2. After the work objects to be changed are indexed and edited, and thereby the ECO phase has been completed, we change the engineering change to the *Review* status. The standard version is configured so that the documents and parts in the *Draft* status are also automatically changed to the *Review* status. Now the *Approval Workflow*, which depicts the review process of the engineering change, appears in the engineering change.

3. Now the *Workflow* and its *Tasks* have to be evaluated and processed by the persons responsible for them. The module *Workflows* is used for this purpose. The subtasks are provided to the person responsible as a structured business process. The *Workflows* are accessed, visualized and adapted according to the basic interaction described in the user manual *Workflows*. The assignment of the engineering change to a project is relevant, since in the standard version the *Workflows* may be able to be evaluated only by certain project members.

4. When the *Workflow* is completed successfully, the status of the engineering change automatically changes to *Completed*.

1.3.3 Scenario 3: With approval and review

In scenario 3 we look at the third case from *Workflow of Engineering Change* (page 3). ECM is created from a template as already shown. Note that all documents and parts to be changed have to be assigned before the approval process. Due to the maturity, objects cannot be added after the approval. Before the change process can be introduced, the application has to be analyzed and evaluated via an *ECR approval Workflow*. Execution of the ECR phase is followed by the second phase (ECO), in which the engineering change is validated so that it can then be approved. The ECR and ECO phases are fully developed in this case.

This scenario always includes the following steps:

1. The engineering change is created in the ECR phase from a template and the relevant work objects are linked to it.

2. Unlike the other scenarios, a status change is followed by the *Evaluation* status and therefore the approval *workflow*.

3. If the *Tasks* of the approval are evaluated positively, the status automatically changes to *Released* and the application is then closed.

4. The status change to *Execution* is followed by the phase of the ECO and thus by the execution of the change process. As in scenario 2, indexes are created and all changes are carried out after the status change to *Execution*. After another status change to *Review*, the second workflow and thus the final *Tasks* are to be evaluated:

5. A successful completion of the *Workflow* automatically initiates a status change of the engineering change to *Completed*; then the engineering change has been successfully closed and the new version of the product is taken over.

Menu access

The *Engineering Change* is provided in the default configuration in the navigation area under the menu item *Products → Engineering Changes*. Access occurs via *Engineering Changes*, which supports search and creation. The submenu items under *Engineering Changes* provide information for the engineering changes already carried out on parts and associated documents.

Along with *Engineering Changes*, *Products → Engineering Changes* also contains the items

Engineering Change Notifications (Parts): Here, messages issued about modifications to parts can be viewed and changed directly.

Engineering Change Notifications (Documents): Here, messages issued about modifications to CAD documents can be viewed and changed directly.

Master data

Engineering Changes are described by the attributes summarized in the data sheet of the *Engineering Change*. The data sheet is usually opened using the *Information* or *Modify...* operations from the pop-up menu of the result list.

Engineering Change no: Here, the system enters a unique sequential change no. automatically.

Template: *Template* check box for labeling engineering change templates. Using this check box, a targeted search can be performed for the available engineering change templates.

Status: Status of the Engineering Change

Phase: Phase progress (ECR, ECO, ECN) (see section *Workflow of an EC* (page 2)).

Description: A text field with the description of the engineering change or engineering change template.

Category: The *Category* of an engineering change. This field indicates in which *Category* the engineering change is located. They each have different amounts of statuses that the engineering change can take on in its life cycle. In the standard version, a *Category* can assume the values *Extensive*, *Standard* and *Simple*.

Project: Indicates the *Project* linked to the engineering change. Even though this is not a mandatory field, it is recommended for most engineering changes since certain processes may only be edited by respective *Project* roles.

Cause: Text field with predefined causes that caused the engineering change to start.

Source: Text field with predefined sources.

Reason: Text field that can be used to specify the exact reason that caused the engineering change to start.

Responsible: Two text fields which are being filled automatically: The creator of the engineering change and his/her role type.

Description: Text field for entering additional descriptions.

Operations and relationships

4.1 Pop-up menu

Once you have received a result list from the search, you can edit the engineering changes via their pop-up menu. To do so, select an engineering change in the result list and open the corresponding pop-up menu by right-clicking. The pop-up menu contains both general functions explained in the user manual *Contact Element Client Reference* and special project functions and commands for calling up the relationships of projects to other objects.

Responsible: Calls up the metadata for the person entered in the engineering change as responsible.

Overview: Calls up the structure tree of the selected engineering change.

Attached Documents: Displays the documents attached to the engineering change.

Parts to be changed: Displays the parts to be changed with the engineering change.

CAD Documents to be changed: Displays the CAD documents to be changed with the engineering change.

Changed Parts: Displays the parts already changed in the course of editing the engineering change.

Changed CAD Documents: Displays the CAD documents already changed in the course of editing the engineering change.

Assignment Rules: Lists the assignment rules.

Status Protocol: Lists the status changes with the date and responsibles.

Project: Opens the context menu of the project linked to the engineering change (see user manual *Projects*).

All other functions are default operations (see user manual for the *Contact Elements Client Reference*).

4.2 Work with engineering changes

4.2.1 Create Engineering Change Template

With Engineering Change Management it is possible to define new templates for engineering changes, which can then be reused as often as desired.

You can create a new engineering change template via *Products → Engineering Changes → New Template....*

Fill in the mandatory field *Category*. Click *New* to confirm the creation.

Linking an engineering change template to a workflow template

In order for an engineering change to include *workflows* such as approvals and testing, the engineering change template has to be linked to the corresponding workflow templates.

The new engineering change template is under *Products → Engineering Changes → Search* if the *Template* check box is enabled.

Using *Workflow template* you can either select existing *workflow templates* by right-clicking *Workflow Template for Engineering Change New..*, or create new workflow templates via *New....* For more about *workflow templates* and *workflows*, see user manual *Workflows*.

When defining the *workflow template*, you can use the following special briefcase name, which is connected to engineering change logic:

ECR or ECO The engineering change will be filed automatically in this briefcase. The Workflows are only visible in the Tree View or the Mask Tab of the engineering change, if you add a briefcase like this to your workflow template. You can use this briefcase, e.g., to trigger a status change at the end of the *workflow* automatically.

Begleitdokumente or Accompanying Documents In those briefcases the Accompaying Documents will be filed automatically.

Zu ändernde CAD-Dokumente or CAD Documents to be changed In those briefcases the CAD Documents to be changed will be filed automatically.

Geänderte CAD-Dokumente or Changed CAD-Documents In those briefcases the modified CAD Documents will be filed automatically after indexing. You can use this briefcase, e.g., to trigger a status change at the end of the *workflow* automatically.

Zu ändernde Artikel or Parts to be changed In those briefcases the Parts to be changed will be filed automatically.

Geänderte Artikel or Changed Parts In those briefcases the modified items will be filed automatically after indexing. You can use this briefcase, e.g., to trigger a status change at the end of the *workflow* automatically.

Note: Your administrator can define further special briefcase names. E.g. to support additional languages.

Assignment Rule

With the Engineering Change Management you can guarantee, that certain changes are subject to the change process.

If you want to enforce that certain classes of documents or parts can only be changed via an engineering change, you must select an appropriate *Assignment Rule* when defining an engineering change template. To do that please proceed as follows:

1. Select the operation *Information* in the pop-up menu of the engineering change template.

2. Move to the tab *Assignment Rule*.

3. Click with the right mouse key in the result list to open the pop-up menu.

4. Select the operation *Engineering Change <-> Rule New*. A dialog to create a new rule opens.

5. Select an object rule and click *New*

All the objects which are described by this object rule, can be changed only if those objects are assigned to the engineering change which derives from its template.

You can define assignment rules for items and documents. The assignment rules will be analysed when using the following operations:

- Change,

- Change Status,

- Indexing.

4.2.2 Start Engineering Change

A mask in which new engineering changes can be created from templates is called up via *Products → Engineering Changes → New from Template*.

These templates take into account different maturities and complexities of the product to be modified. After selecting a template, this is confirmed with the *New from Template* button.

Now the *Cause* and *Source* of the engineering change are entered. The engineering change is created by clicking *New from Template*.

4.3 Adding accompanying documents, CAD documents and parts

In the Overview you can assign *Documents* and *Parts* to the EC. You find the Overview when you search for *Engineering Changes*, right click the desired *Engineering Changes* in the search result and select the operation *Overview*.

To ensure the identification of the affected work objects (models, drawings and attached documents), you can open the respective pop-up menu in the *Attached Documents*, *CAD documents to be changed*, or *Parts to be changed* menu items and assign these to the engineering change using *New...* or *Assignment New...*.

Assignment New...: Opens a search mask for the object selection.

Note: You can add *CAD Documents* and *Parts* in standard version only, if they have the *Approved* status.

Note: You can assign *CAD Documents* and *Parts* to the engineering change only, as long as the *Project* has not exceeded the *New* status.

4.4 State change

Status changes can generally be carried out for engineering changes as described in the user manual *Contact Elements Client Reference* in the chapter *Standard functions*.

However, depending on the engineering change template and status, it is possible for individual status changes only to be processed automatically by completing *workflows*. These *workflows* and their *tasks* can be seen either in the overview of the engineering change or in the task manager (see user manual *Task Manager*) of the person responsible for the *workflow*.

For more details about *workflows*, see user manual *Workflows*.

To update the engineering change, you have to select the engineering change in the structure tree and press F5.

4.5 Indexing/changed CAD documents, changed parts

To change objects they first have to be revisioned, i.e. a new index of the current documents and parts has to be created that the designers and developers can use to carry out the change work. This version later supersedes the old version and becomes the current version. Despite this, the old version remains in existence for archiving purposes but is marked *Obsolete*. To do this, go to the document or item to be changed in the overview of the engineering change, open the pop-up menu and click *Create index*. The engineering change must be in the *Execution* status to index.

The indexed work objects then appear in *Changed Documents* and *Changed Items*.

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