



AD FALCON API Manual

# Step Materials (% Step Materials)

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## 1 Step Materials (% Step Materials)

% Step Materials lets you **switch** the material assignment of selected elements at a specific **step start**, by referencing a material that is already defined in % Materials.

This is useful for staged workflows (e.g., “geostatic → loading”) where a region should start using a different constitutive model or parameter set at the moment a step begins.

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### 1.1 When it runs

For a given step, the update is applied at **step start**, before any assembly/solve for that step.

Within the step-start sequence, % Step Materials runs after:

- Step-triggered initial assignments (% Step Initial Assignments), and
- Element activation/deactivation (birth/kill) scheduled for that step.

If the step enables UMAT initialization on activation (@@ElementBirthInitializeUMAT: Yes), that activation-time UMAT initialization runs first; then % Step Materials can overwrite the element material IDs.

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### 1.2 Syntax

```
% Step Materials
@Step <stepId>:
  @@MaterialId: <materialIdFromMaterials>
  @@Elements: All | <elemIdOrRange> [<elemIdOrRange> ...]
%%%
```

Formatting notes:

- Section header variants are accepted: % Step Materials, % StepMaterialUpdates, % StepMaterialAssignments.
- @Step headers are flexible (for example: @Step 3, @Step 3:, @Step: 3).
- Keys in this section are treated case-insensitively.
- A trailing : after a key is allowed.
- @@Elements accepts All, IDs separated by spaces/commas/semicolons, and inclusive ranges written as lo-hi or lo:hi.

### 1.3 Controls

Directive	Required	Default	Meaning
@Step <stepId>	Yes	(none)	Selects the step where the material reassignment is applied (at step start).
@@MaterialId	Yes	(none)	The target material ID (must already exist in % Materials). Aliases: @@Material, @@Id.
@@Elements	Yes	(none)	Element IDs/ranges (or All) that will have their material ID overwritten at this step start. Aliases: @@ElementIds, @@ElementId.

### 1.4 Rules and constraints

- @@MaterialId must refer to an existing material defined in % Materials (otherwise FALCON errors).
- At step start, FALCON overwrites the material assignment for the listed elements. The new material ID persists for subsequent steps unless overwritten again by a later % Step Materials block.
- UMAT materials are supported as long as they are defined in % Materials (then referenced by ID in % Step Materials).

### 1.5 Checkpoint / restart

For restart runs:

- Keep the same % Step Materials definitions in the input file.
  - FALCON replays step-material updates up to the checkpoint time so the correct material assignments are active when the restored state is used.
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## 1.6 Example

For a complete worked example that switches from a geostatic linear-elastic step to a ClayElasticity UMAT step using % Step Materials, see:

- [Footing on Soil Modeled by the Cam Clay Elasticity Model](#)

