MES Production Confirmation - POC Demo Document

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Executive Summary

This POC delivers a functional MES application demonstrating:

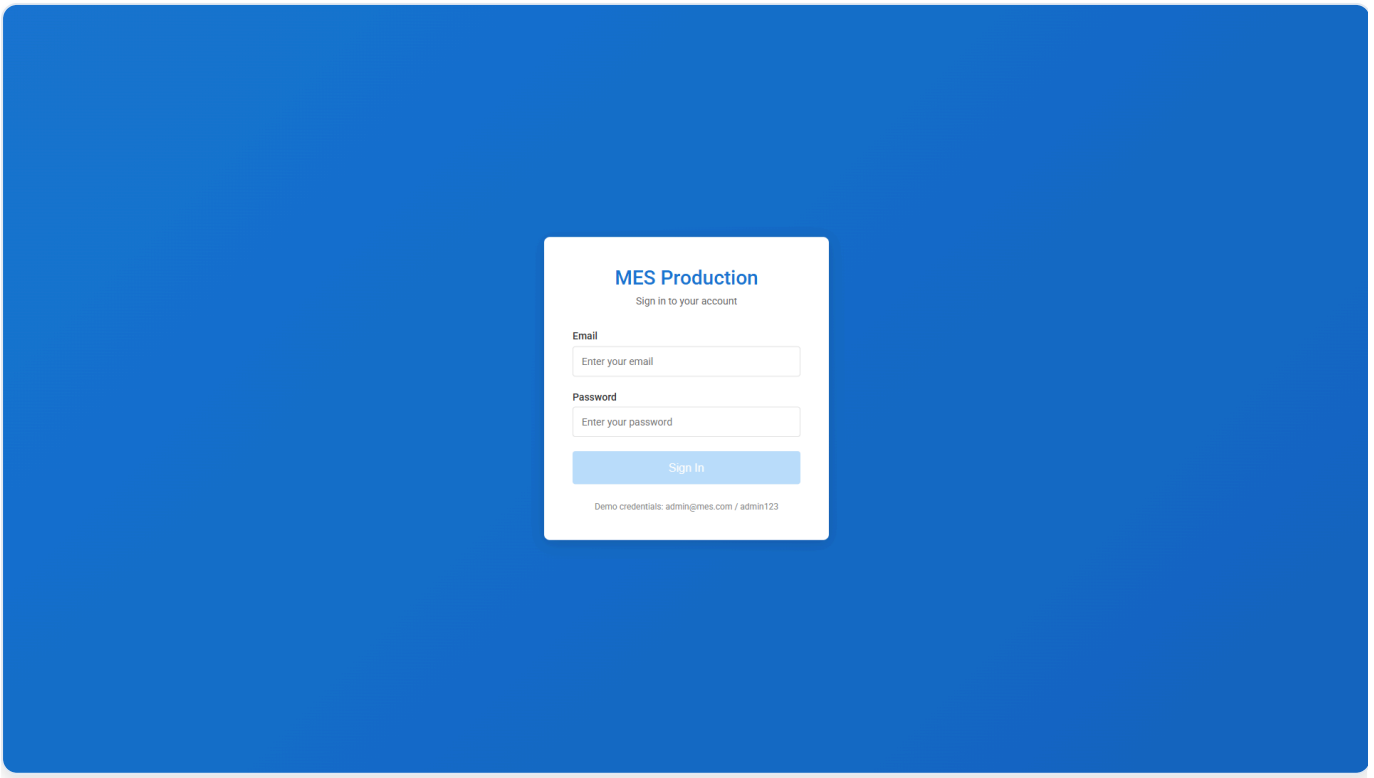
Deliverable	Description	Status
Core Production Engine	Multi-level BOMs, Batch Parent-Child (Split/Merge)	Complete
Execution UI	4 screens: Login, Order Dashboard, Production Confirmation, Traceability	Complete
Business Logic	Consumption validation, scrap tracking, equipment/operator assignment	Complete
Data Foundation	Pre-seeded PostgreSQL database ready for demo	Complete

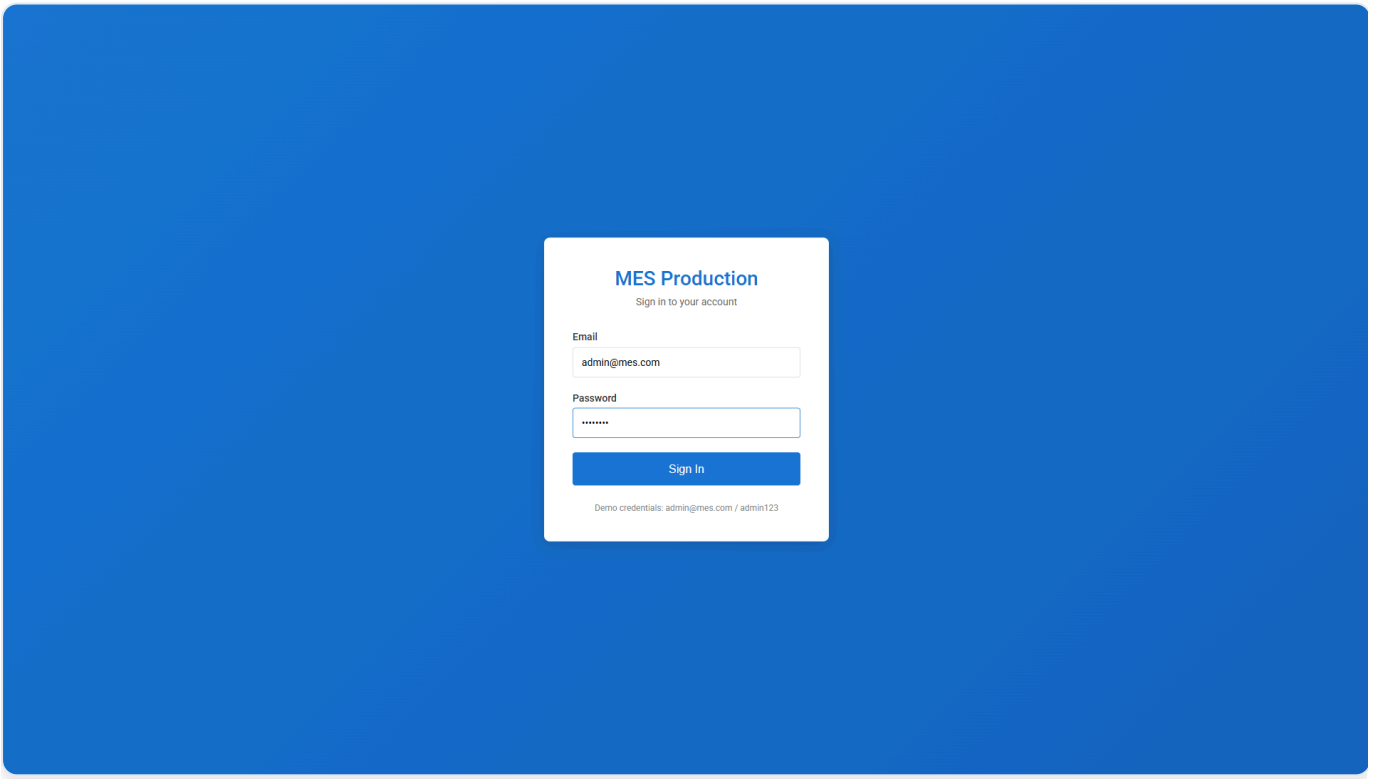
Demo Access:

- URL: `http://localhost:4200`
- Email: `admin@mes.com`
- Password: `admin123`

Screen 1: Login

Route: `/#/login`


MES Production
Sign in to your account
Email
Enter your email
Password
Enter your password
Sign In
Demo credentials: admin@mes.com / admin123


MES Production
Sign in to your account
Email
admin@mes.com
Password
Sign In
Demo credentials: admin@mes.com / admin123

Login Flow

```
User enters credentials → System validates → JWT token issued → Redirect to Dashboard
```

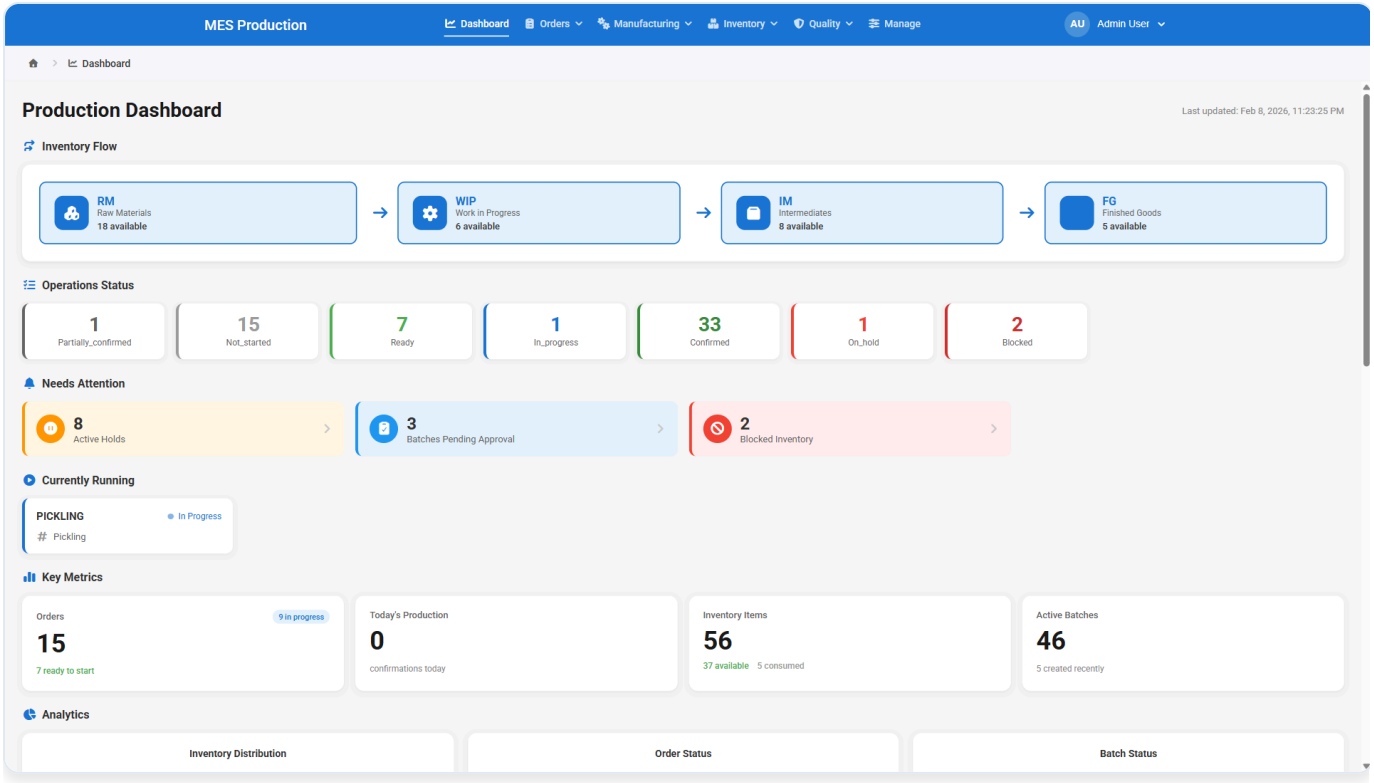
Actions

Action	Result
Enter valid credentials + Login	JWT token stored, redirect to Dashboard
Enter invalid credentials + Login	Error message displayed
Access protected page without token	Redirect to Login

Screen 2: Order Dashboard

Dashboard

Route: `/#/dashboard`



Dashboard Flow

```
Dashboard loads → Fetch statistics → Display metrics → Show quick actions
```

Dashboard Actions

Action	Result
Click "Confirm Production"	Navigate to Production Confirmation
Click "View Orders"	Navigate to Orders list
Click "Batch Traceability"	Navigate to Batches list
Click inventory type (RM/IM/FG)	Navigate to Inventory filtered by type

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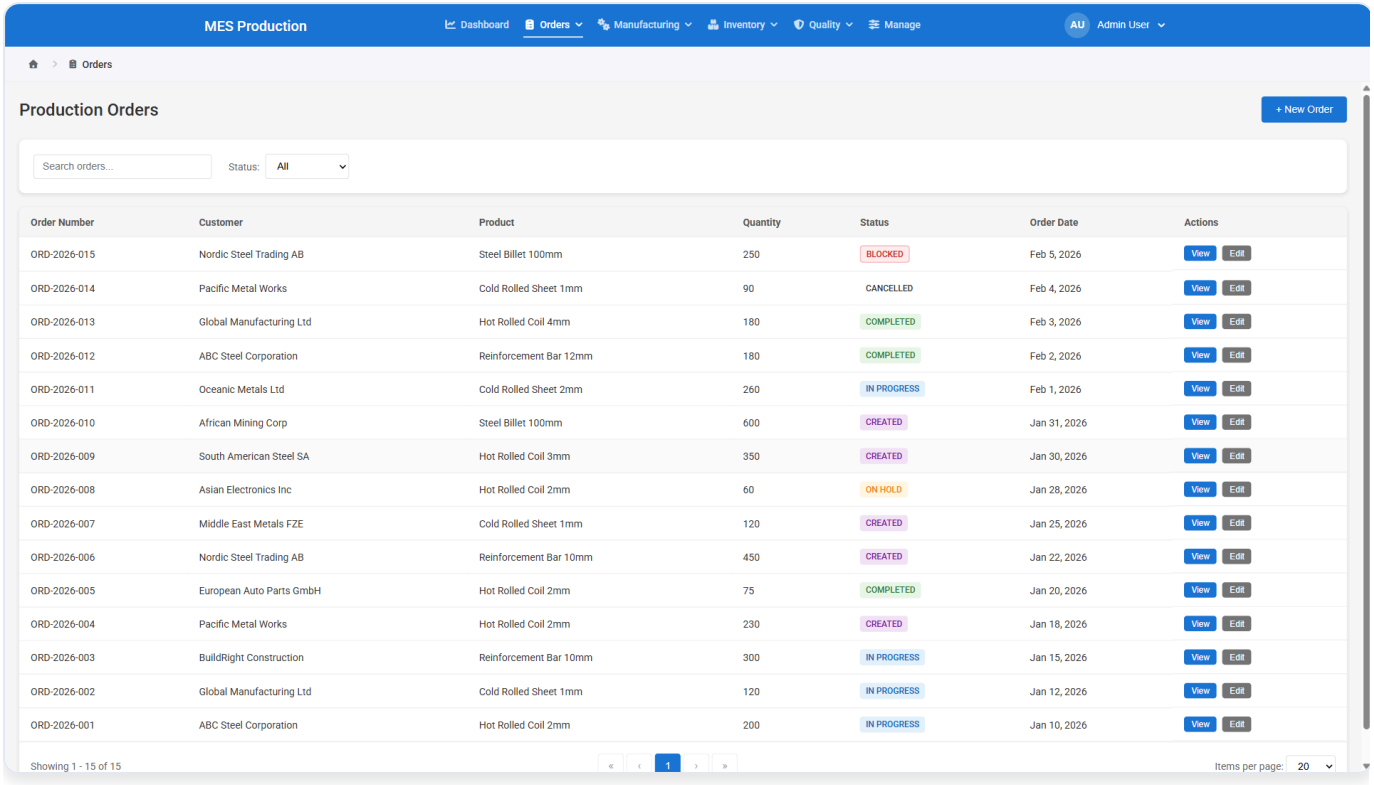
Orders List

Route: `/#/orders`



Orders List Flow

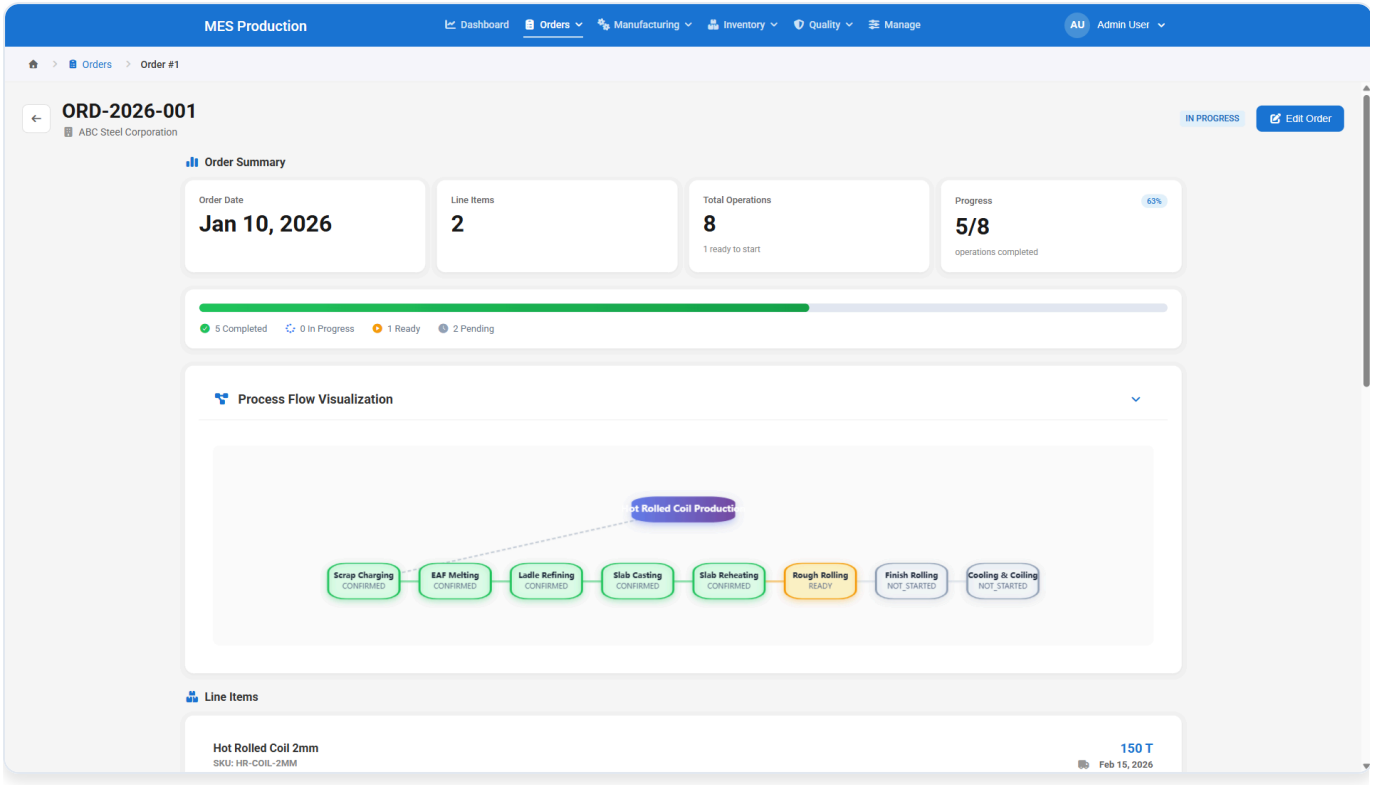
```
Page loads → Fetch orders → Display in table → User can filter/search
```

Orders List Actions

Action	Result
Select status filter	Table filtered by selected status
Enter search text	Table filtered by order number/customer
Click order row	Navigate to Order Detail
Click pagination	Load next/previous page

Order Detail

Route: `/#/orders/:id`



Order Detail Flow

```
Page loads → Fetch order with line items → Fetch operations → Display process flow chart → S
```

Order Detail Actions

Action	Result
Click "Start Production" on READY operation	Navigate to Production Confirmation for that operation
Click line item	Expand/collapse operations
Click operation	View operation details
Click "Back"	Return to Orders list

Operation Status Logic

Current Status	Can Confirm?	Next Status After Confirm
NOT_STARTED	No	-
READY	Yes	IN_PROGRESS or CONFIRMED
IN_PROGRESS	Yes	CONFIRMED (if complete)
CONFIRMED	No	-
ON_HOLD	No	-

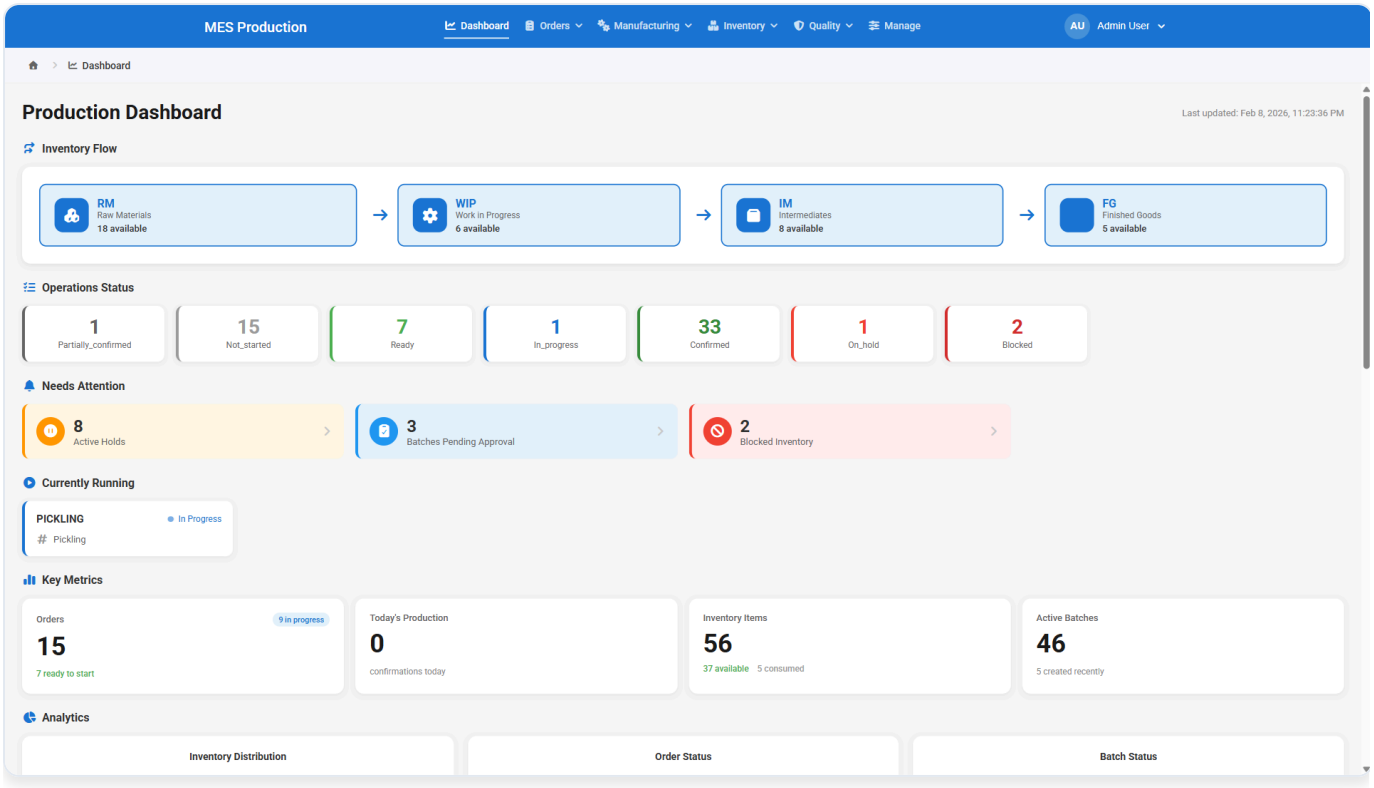
Status Transition Flow

```
Order created:
  └─ All operations → NOT_STARTED
  └─ First operation → READY

After confirming operation:
  └─ Current operation → CONFIRMED (if complete) or IN_PROGRESS (if partial)
  └─ Next operation → READY (if previous confirmed)

All operations confirmed:
  └─ Order status → COMPLETED
```

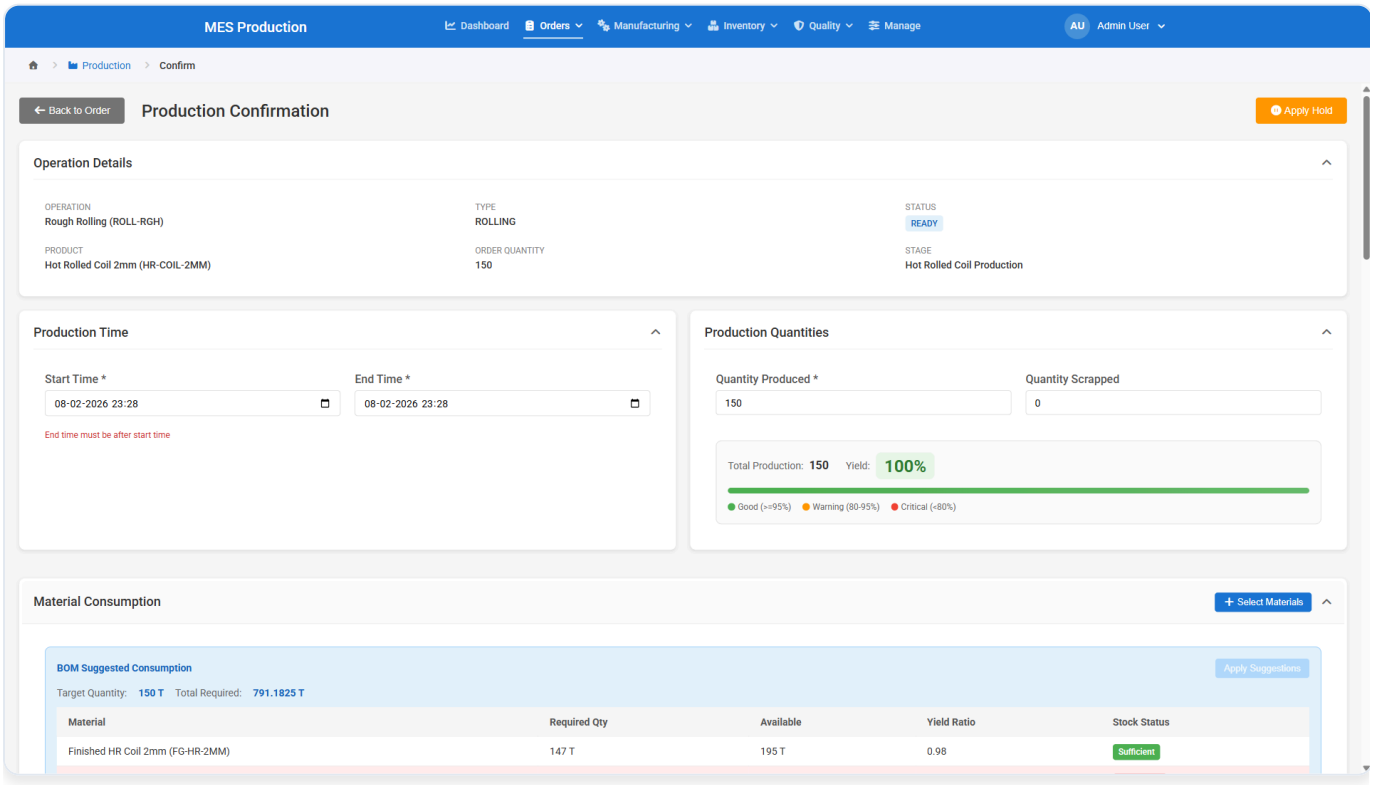
Screen 3: Production Confirmation

Route: `/#/production/confirm` or `/#/production/confirm/:operationId`

Empty Form



With Operation Selected

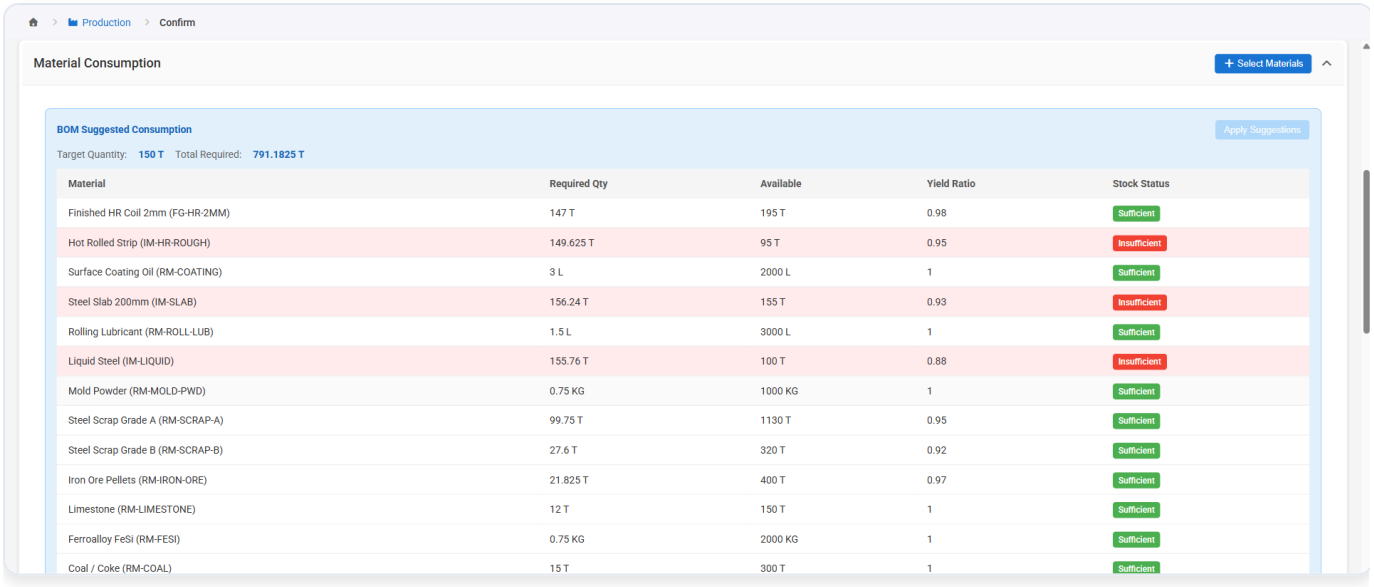


Production Confirmation Flow

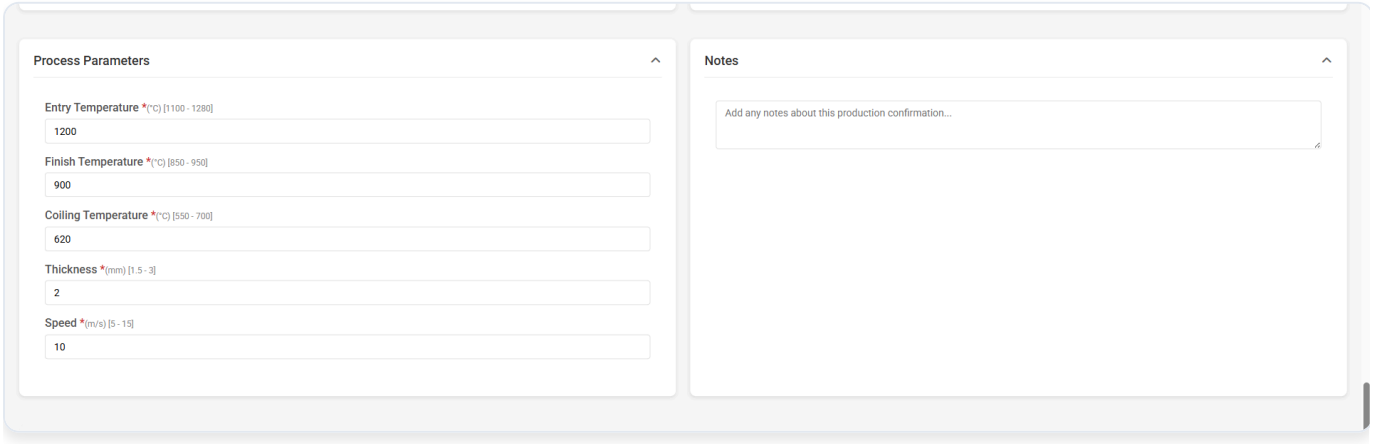
```
┌─────────────────────────────────────────────────────────────────────────┐
│                    PRODUCTION CONFIRMATION FLOW                         │
├─────────────────────────────────────────────────────────────────────────┤
│                                                                         │
│  1. SELECT ORDER & OPERATION                                            │
│     └─ Only orders with READY operations shown                          │
│     └─ Only READY operations available for selection                    │
│                                                                         │
│  2. VIEW OPERATION DETAILS                                              │
│     └─ Process name, operation type, target quantity                    │
│                                                                         │
│  3. SELECT INPUT MATERIALS                                              │
│     └─ Available batches shown (status = AVAILABLE)                     │
│     └─ Enter quantity to consume from each batch                        │
│     └─ Validation: qty ≤ available qty                                  │
│                                                                         │
│  4. ENTER PRODUCTION TIMES                                              │
│     └─ Start time, End time                                             │
│     └─ Validation: end time ≥ start time                                │
│                                                                         │
│  5. ENTER QUANTITIES                                                    │
│     └─ Produced quantity (good output)                                  │
│     └─ Scrap quantity (waste)                                           │
│                                                                         │
│  6. SELECT EQUIPMENT & OPERATORS                                        │
│     └─ Equipment dropdown (only AVAILABLE equipment)                    │
│     └─ Operators dropdown (only ACTIVE operators)                       │
│                                                                         │
│  7. ENTER PROCESS PARAMETERS                                            │
│     └─ Dynamic fields based on operation type                           │
│     └─ Validation: values within min/max limits                         │
│                                                                         │
│  8. CLICK CONFIRM                                                       │
│     └─ Validation passes → Execute confirmation                         │
│     └─ Validation fails → Show errors                                   │
│                                                                         │
└─────────────────────────────────────────────────────────────────────────┘
```

Form Sections

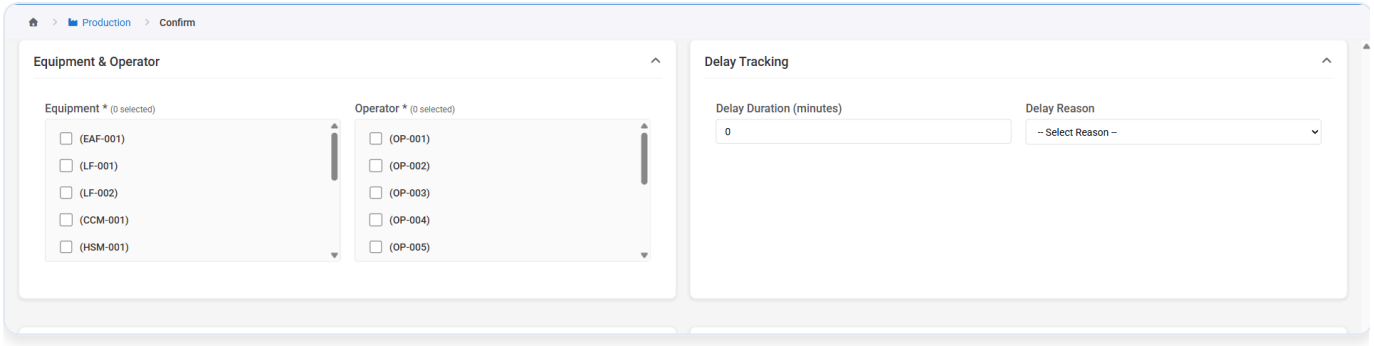
1. Material Consumption



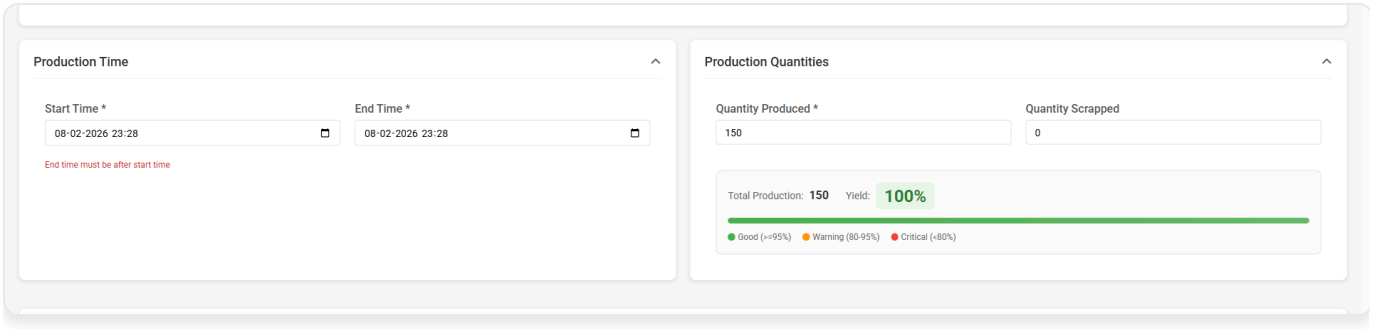
2. Process Parameters



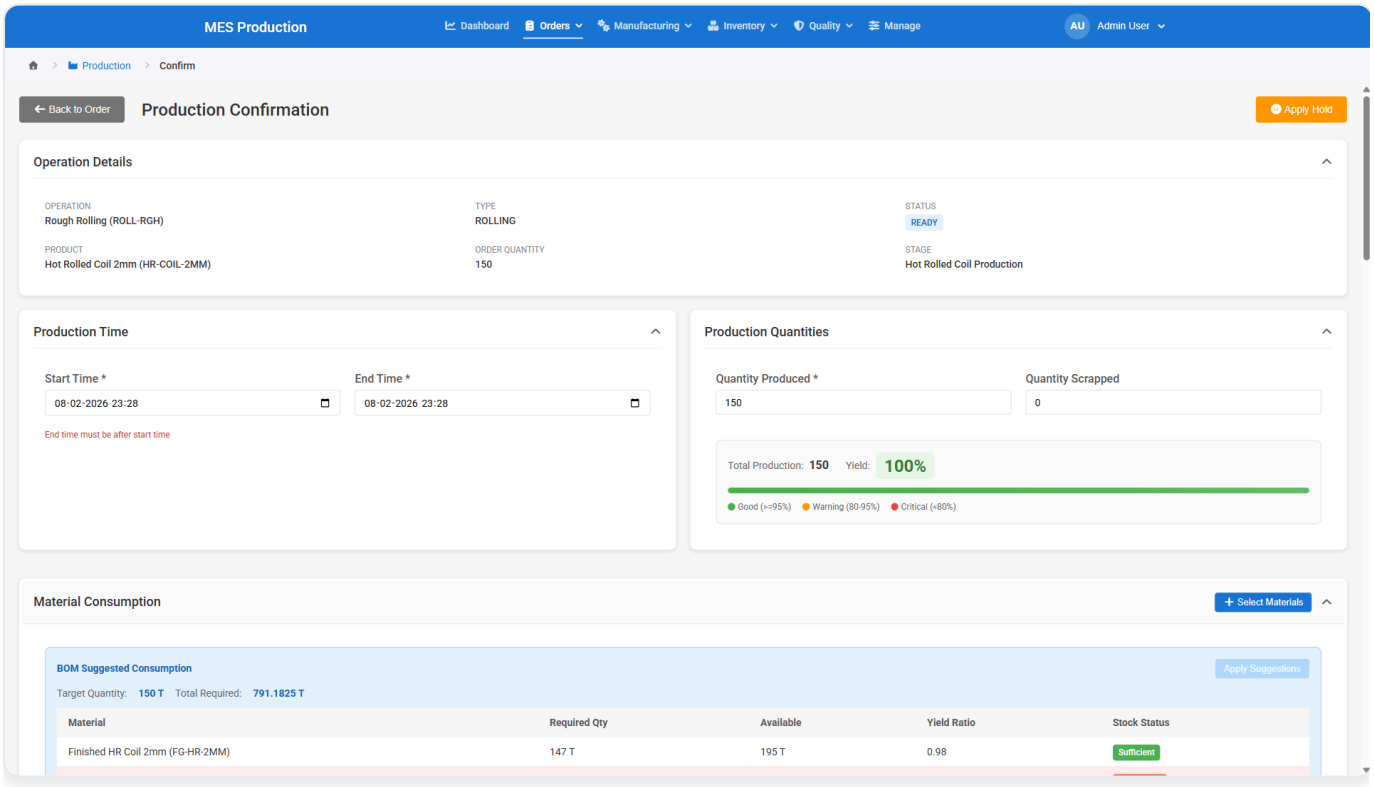
3. Equipment & Operators



4. Output



5. Confirm Button



On Confirmation - System Actions

```
┌─────────────────────────────────────────────────────────────────────────┐
│                    SYSTEM ACTIONS ON CONFIRMATION                       │
├─────────────────────────────────────────────────────────────────────────┤
│                                                                         │
│  1. VALIDATE ALL INPUTS                                                 │
│     └─ Check required fields                                            │
│     └─ Check quantity validations                                       │
│     └─ Check parameter limits                                           │
│                                                                         │
│  2. CREATE PRODUCTION CONFIRMATION RECORD                               │
│     └─ Store all entered data                                           │
│     └─ Link to operation, equipment, operators                          │
│     └─ Record process parameters                                        │
│                                                                         │
│  3. CONSUME INPUT MATERIALS                                             │
│     └─ For each selected batch:                                         │
│         └─ Create ConsumedMaterial record                               │
│         └─ Update inventory state → CONSUMED                            │
│         └─ Record consumed quantity                                     │
│                                                                         │
│  4. CREATE OUTPUT BATCH                                                 │
│     └─ Generate batch number                                            │
│     └─ Status = QUALITY_PENDING                                         │
│     └─ Create BatchRelation (parent → child genealogy)                  │
│                                                                         │
│  5. CREATE OUTPUT INVENTORY                                             │
│     └─ State = PRODUCED                                                 │
│     └─ Link to output batch                                             │
│                                                                         │
│  6. UPDATE OPERATION STATUS                                             │
│     └─ If produced qty = target qty → CONFIRMED                         │
│     └─ If produced qty < target qty → IN_PROGRESS (partial)             │
│                                                                         │
│  7. ADVANCE NEXT OPERATION                                              │
│     └─ If operation CONFIRMED and has next:                             │
│         └─ Next operation → READY                                       │
│                                                                         │
│  8. UPDATE ORDER STATUS                                                 │
│     └─ If all operations CONFIRMED → Order status = COMPLETED           │
│                                                                         │
│  9. LOG AUDIT TRAIL                                                     │
│     └─ Record all changes with timestamps                               │
│     └─ User attribution                                                 │
│                                                                         │
└─────────────────────────────────────────────────────────────────────────┘
```

Validation Rules

Field	Validation	Error Message
Order	Required	Please select an order
Operation	Required	Please select an operation
Start Time	Required	Start time is required
End Time	Required, ≥ Start Time	End time must be after start time
Produced Qty	Required, > 0	Produced quantity must be greater than 0
Scrap Qty	≥ 0	Scrap quantity cannot be negative
Material Qty	≤ Available	Cannot consume more than available
Parameters	Within min/max	Value must be between X and Y

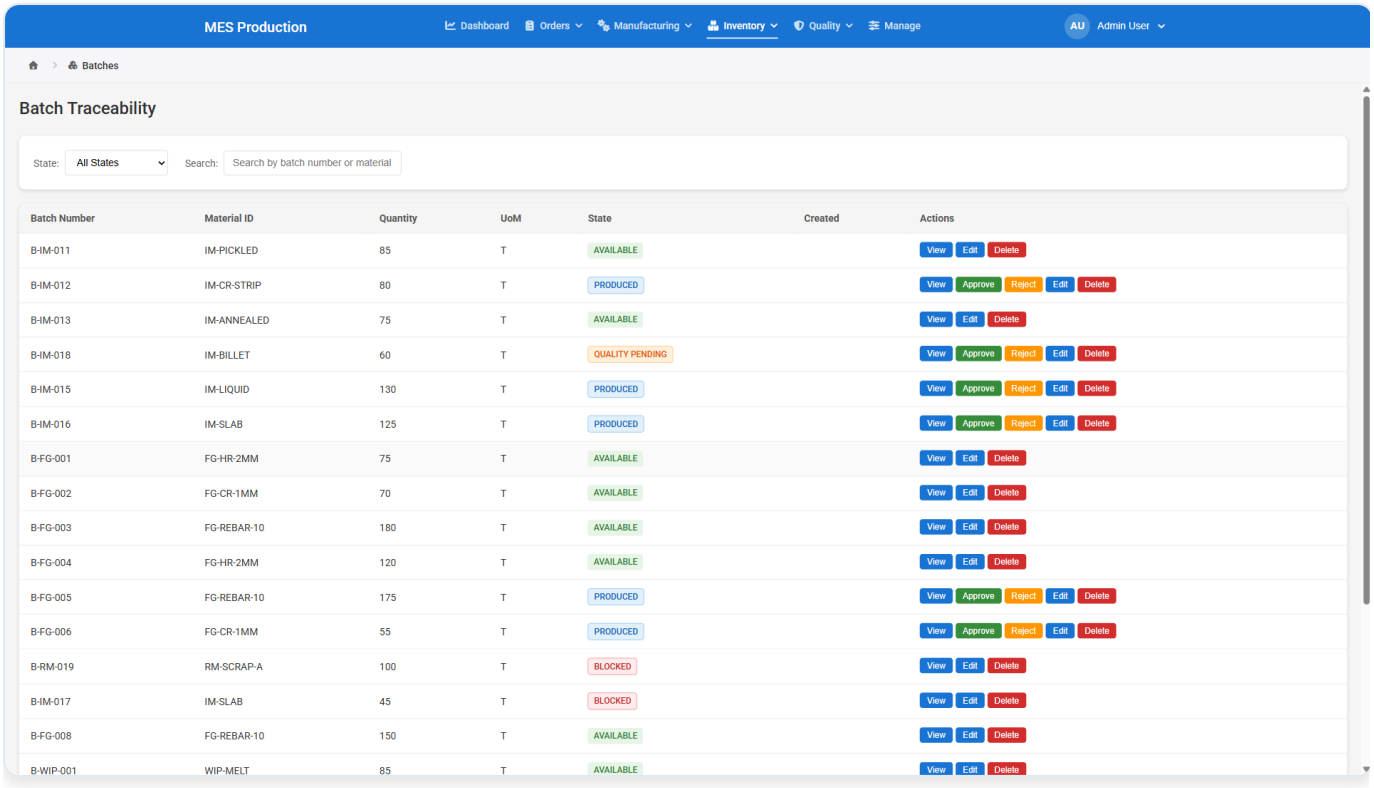
Multi-Level BOM Logic

```
Example: Producing HR Coil

STEP 1: MELTING (consumes raw materials)
  Input:  B-RM-SCRAP-001 (Steel Scrap)
          B-RM-ORE-001 (Iron Ore)
  Output: B-WIP-LS-001 (Liquid Steel)

STEP 2: CASTING (consumes WIP from previous step)
  Input:  B-WIP-LS-001 (Liquid Steel)
  Output: B-IM-SLAB-001 (Steel Slab)

STEP 3: ROLLING (consumes IM from previous step)
  Input:  B-IM-SLAB-001 (Steel Slab)
  Output: B-FG-COIL-001 (HR Coil)

Each step creates genealogy links:
  B-RM-SCRAP-001 ─┐
  B-RM-ORE-001 ───┼→ B-WIP-LS-001 → B-IM-SLAB-001 → B-FG-COIL-001
```

Screen 4: Traceability View

Route: `/#/batches`

Batch List



Batch List Flow

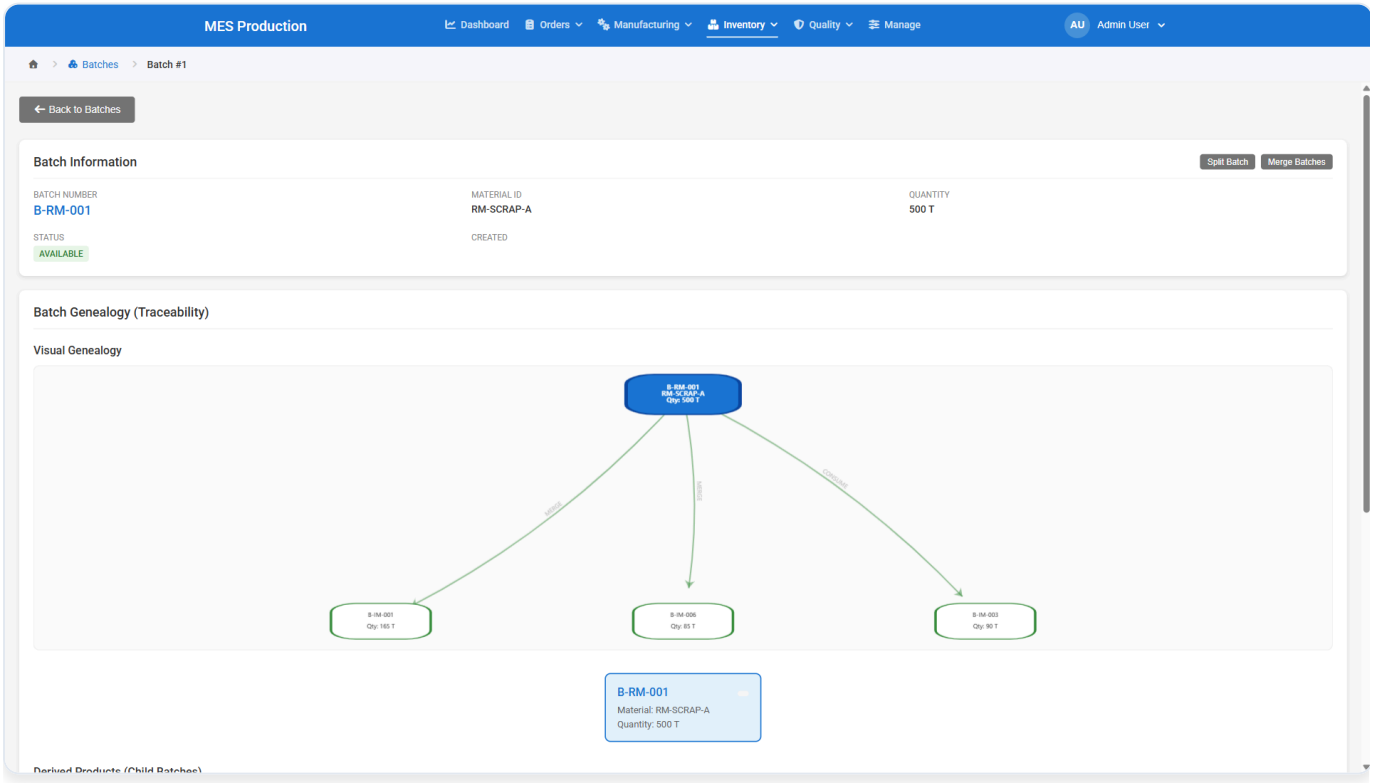
```
Page loads → Fetch batches → Display in table → User can filter by status
```

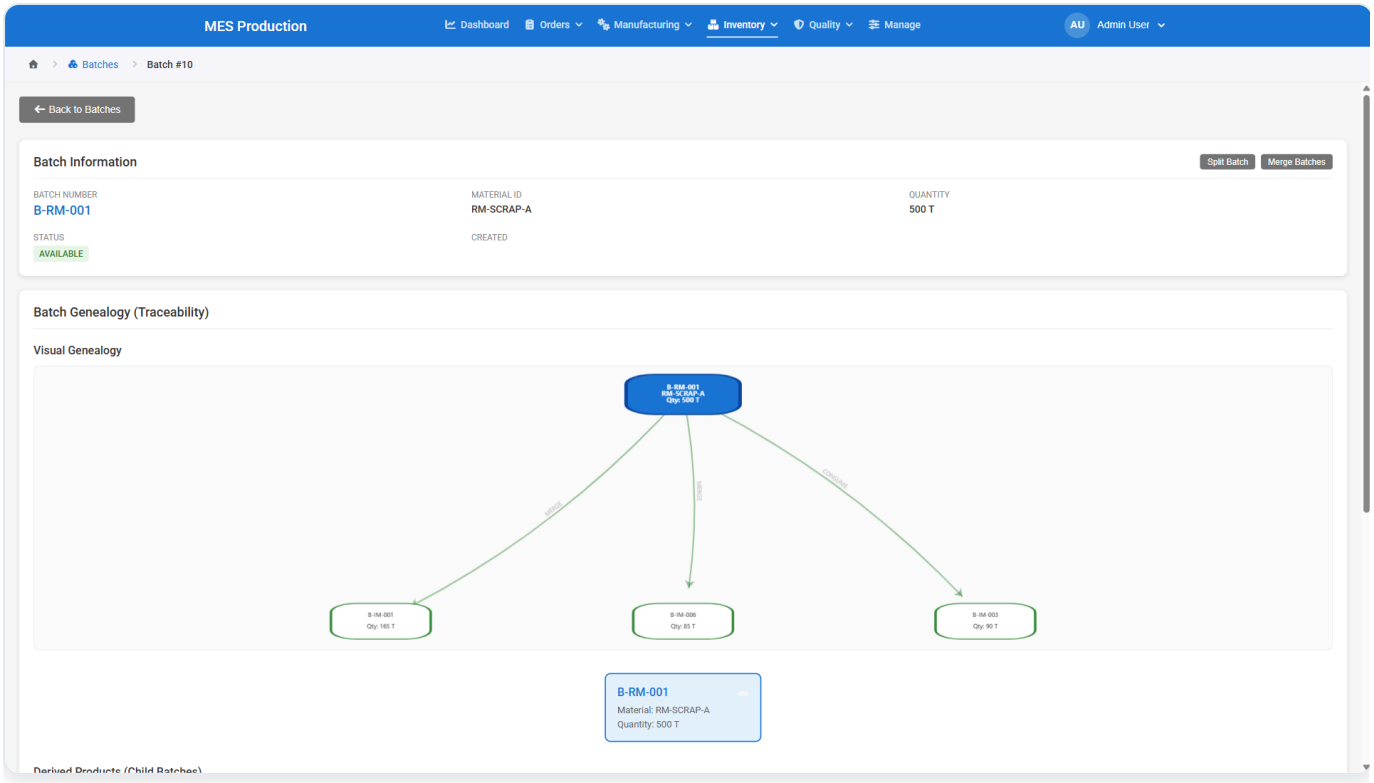
Batch List Actions

Action	Result
Select status filter	Table filtered by batch status
Enter search text	Table filtered by batch number/material
Click batch row	Navigate to Batch Detail
Click "Approve" (if QUALITY_PENDING)	Batch status → AVAILABLE
Click "Reject" (if QUALITY_PENDING)	Batch status → BLOCKED

Batch Detail with Genealogy

Route: `/#/batches/:id`

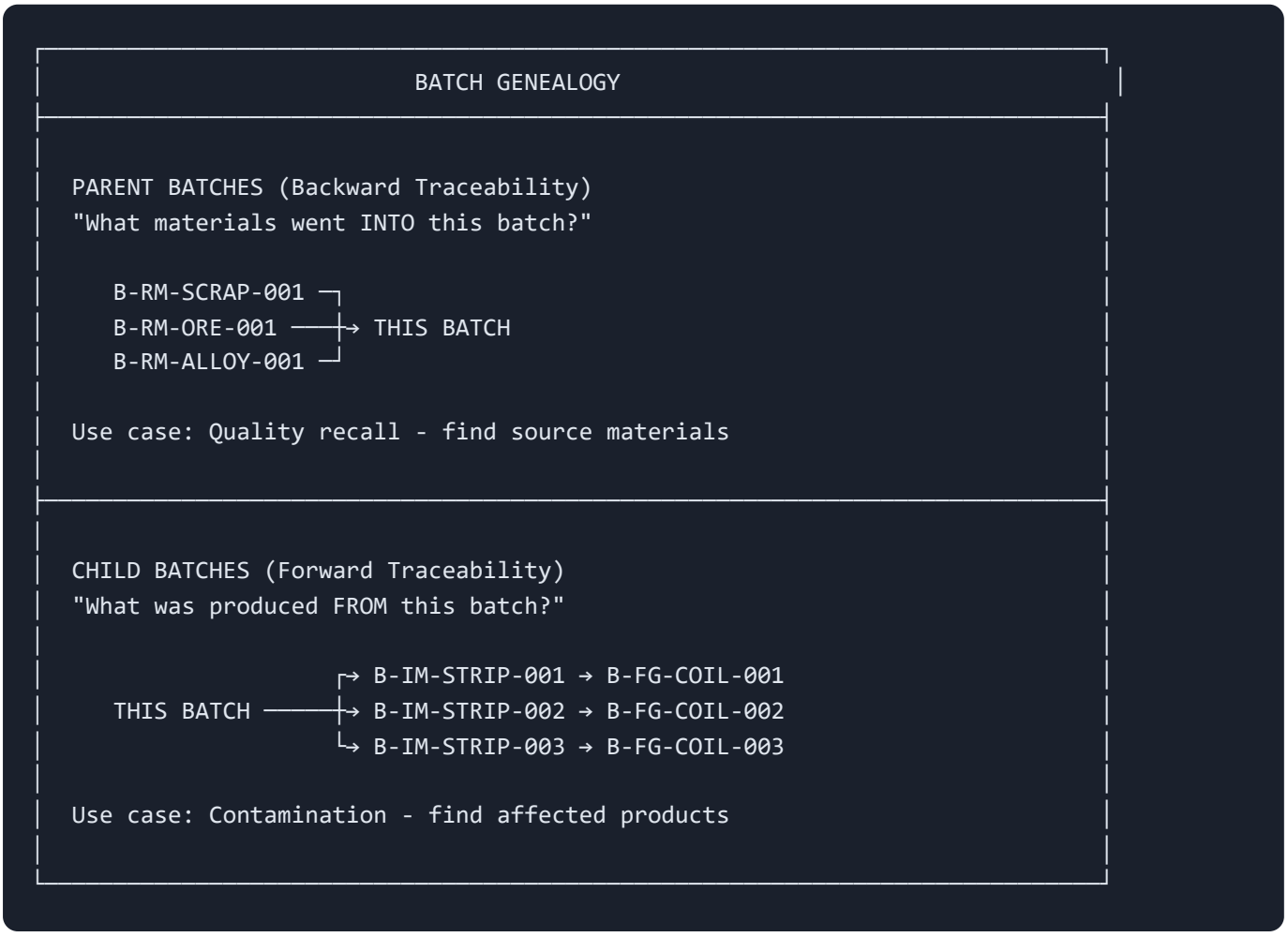




Batch Detail Flow

```
Page loads → Fetch batch → Fetch genealogy (parents + children) → Display batch info and ge
```

Genealogy Logic



Batch Actions

Action	Available When	Result
Approve	Status = QUALITY_PENDING	Status → AVAILABLE
Reject	Status = QUALITY_PENDING	Status → BLOCKED
Split	Status = AVAILABLE	Creates child batches, original quantity reduced
Click parent batch	Has parents	Navigate to parent batch
Click child batch	Has children	Navigate to child batch

Split Operation Flow

```
BEFORE SPLIT:
  B-IM-SLAB-001 (Quantity: 100T, Status: AVAILABLE)

SPLIT ACTION:
  Split into: 60T, 40T

AFTER SPLIT:
  B-IM-SLAB-001 (Quantity: 0T, Status: SPLIT)
     ├→ B-IM-SLAB-001-A (Quantity: 60T, Status: AVAILABLE)
     └→ B-IM-SLAB-001-B (Quantity: 40T, Status: AVAILABLE)

Genealogy: B-IM-SLAB-001 is PARENT of both child batches
```

Merge Operation Flow

```
BEFORE MERGE:
  B-IM-SLAB-001 (Quantity: 30T, Status: AVAILABLE)
  B-IM-SLAB-002 (Quantity: 40T, Status: AVAILABLE)
  B-IM-SLAB-003 (Quantity: 30T, Status: AVAILABLE)

MERGE ACTION:
  Merge all three batches

AFTER MERGE:
  B-IM-SLAB-001 (Status: MERGED)
  B-IM-SLAB-002 (Status: MERGED)
  B-IM-SLAB-003 (Status: MERGED)
     └→ B-IM-SLAB-MERGED-001 (Quantity: 100T, Status: AVAILABLE)

Genealogy: All three original batches are PARENTS of merged batch
```

Batch Status Flow

```
NEW BATCH CREATED:
  └─ From Production Confirmation → QUALITY_PENDING
  └─ From Material Receipt → QUALITY_PENDING

QUALITY DECISION:
  └─ Approve → AVAILABLE
  └─ Reject → BLOCKED

AVAILABLE BATCH:
  └─ Used in production → CONSUMED
  └─ Split → SPLIT (original), children = AVAILABLE
  └─ Put on hold → ON_HOLD

ON_HOLD BATCH:
  └─ Release hold → AVAILABLE

BLOCKED BATCH:
  └─ Scrap decision → SCRAPPED
```

Demo Scenarios

Scenario 1: Complete Production Confirmation

1. Login as admin@mes.com
2. Go to Orders list
3. Click on order ORD-2026-001 (IN_PROGRESS)
4. Find READY operation, click "Start Production"
5. Select input materials, enter quantities
6. Enter start/end times
7. Enter produced quantity, scrap quantity
8. Select equipment and operators
9. Enter process parameters
10. Click "Confirm Production"
11. **Verify:**
    - Success message with new batch number
    - Operation status → CONFIRMED

- Next operation → READY
- Navigate to batch, verify genealogy shows parent batches

Scenario 2: Batch Traceability

1. Go to Batches list
2. Click on a batch (e.g., B-FG-COIL-001)
3. View genealogy section
4. **Backward trace:** Click parent batches to see inputs
5. **Forward trace:** Click child batches to see outputs
6. Navigate complete chain: FG → IM → WIP → RM

Technical Summary

Technology Stack:

- Frontend: Angular 17
- Backend: Spring Boot 3.2
- Database: PostgreSQL 14+
- Authentication: JWT

Demo Data:

Entity	Count
Orders	8
Products	6
Materials	24
Equipment	12
Operators	8
Batches	27

End of Document