

How to Lay Out a Warehouse or Distribution Center

A thick, horizontal yellow brushstroke with a textured, painterly appearance, spanning across the width of the slide below the first title.

Layout & Equipment Installation

Warehouse Move Checklist

Main Points

1. A lot can go wrong when moving or rearranging a warehouse or distribution center. Risks can be better managed with a comprehensive move plan.
2. The Warehouse Move Checklist (RMA 712) is pre-defined to capture the most common tasks. It is a reference list from which to populate a Gantt Chart for your project.
3. Different types of equipment are listed. These can be deleted if not present or involved.
4. Some tasks are merely suggestive reminders that may result in additional tasks be inserted.
5. The checklist has columns for start and finish dates, number of calendar days, and color-coded status.

The image displays five overlapping copies of the 'WAREHOUSE MOVE CHECKLIST' form. Each form is titled 'WAREHOUSE MOVE CHECKLIST' and includes fields for 'Company', 'Project', 'Status as of', 'Date', and 'Page'. The main table has the following columns: 'Task #', 'Description', 'Start', 'Finish', 'Calendar Days', '% Comp', 'Status', and 'Comments'. The status column is color-coded: green for '100%', yellow for '50%', and red for '0%'. The forms show various tasks such as 'Analyze Move Risks', 'Develop a Pull System for Evacuation of Inventory Move', 'Install Warehouse Location Labeling', and 'Install Location Labels, Signs and Stripes'.

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Notes

Main Points

1. When the new layout involves installation of new automated equipment and systems, additional implementation planning tasks are needed.
2. The list here is generally applicable to projects dependent upon software, hardware and their integration with mechanical systems.
3. System integrators and suppliers will have their own standard task lists and will manage their work, but the planner still needs a comprehensive project plan with Gantt Chart that covers the major activities associated with new automation.
4. This is especially true with respect to sourcing, before integrators or suppliers are on board. And to acceptance testing and training as installation and commissioning draws near.

Phase IV Implementation

Standard activities list for new automation.

IV.1 Finalize Sourcing Decisions

- 1.1 Issue RFP(s)
- 1.2 Review Supplier Response(s)
- 1.3 Review Reference Sites
- 1.4 Resolve Technical Issues
- 1.5 Negotiate and Award Contract

IV.2 Complete Technical Engineering

- 2.1 Establish Review Points & Milestones: 30%, 70%, 100%
- 2.2 Review Proposed Technical Solutions: 30% review point
- 2.3 Develop Details & Prototypes: 70% review (may include Pilot)
- 2.4 Finalize Development Plan (for new code, setup, configuration, integration, capacity ...)
- 2.5 Approve Technical Engineering: 100% review

IV.3 Develop Systems & Procedures

- 3.1 Establish Review Points & Development Management
- 3.2 Develop, Code/Configure Software, including Testing
- 3.3 Write User Procedures & Training Manuals
- 3.4 Develop Installation Plans
- 3.5 Approve Installation Plans (includes final demonstrations)

IV.4 Install, Test & Train

- 4.1 Establish Installation Management
- 4.2 Prepare Sites, Hosts, Desktops and Networks
- 4.3 Train Maintenance & Initial User Personnel
- 4.4 Install Hardware, Software & Equipment
- 4.5 Conduct Integration & Acceptance Tests (Confirm Task 3 tasks)

IV.5 Activate & Monitor Results

- 5.1 Convert Existing Data
- 5.2 Activate Management & Procedural Changes
- 5.3 Expand User Training
- 5.4 Monitor System Performance (Post-installation audit)
- 5.5 Plan Corrective Actions

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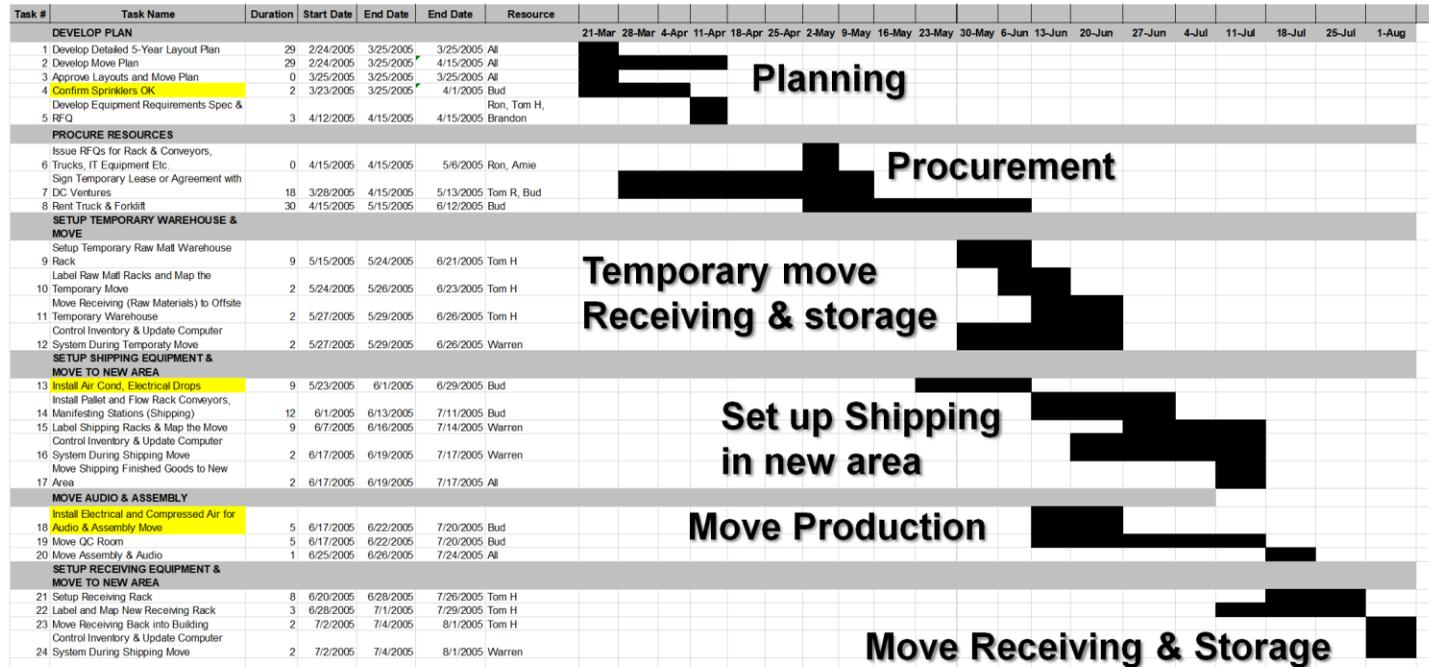
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Notes

Main Points

1. On small, simple rearrangements, the operators themselves may make the installation, using no more than a handwritten task list on a flip chart or white board.
2. But large, complex installations often require a variety of skilled trades, outside services, suppliers, contract movers and installers.
3. Each requires time and labor and their work may need to be preceded by or interleaved with that of the others.
4. Detailed instructions and schedules, and usually an expense budget will be needed.
5. The Gantt Chart is the best way to schedule and monitor the work on significant projects where a simple list is not sufficient..

Installation Planning Example



The Gantt Chart is a customary tool for installation planning. This one covers the rearrangement and expansion of a facility into additional adjoining space. Receiving, Raw Materials Storage, Finished Goods and Shipping all move in addition to Production. As is often the case, a temporary move is necessary, here for Receiving and Raw Materials. These will both move twice.

A good practice is to build the task list with representatives of each affected area.

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Notes

Installation Scope?

Main Points

1. Moving machinery and equipment offers an opportunity to make other changes and improvements in the operation. The possible improvements listed here should be considered.
2. Where such actions are desirable, they must be built into the schedule and assigned to the appropriate individuals or teams.

- Repair, rebuild, or repaint equipment.
- Add new fittings, attachments, feeds, deliveries.
- Initiate new working methods, procedures, controls.
- Abandon bad operating practices of all kinds.
- Convert to new materials or new product specifications.
- Realign the manpower assignments, balancing, skills, and time standards.
- Incorporate better safety practices.
- Repair the floors, walls, ceilings, and do other major maintenance work.
- Realign supervisory responsibilities.
- Housekeeping; removal of unnecessary items from the floor.
- Implementation of visual management:
 - signage,
 - color codes,
 - display boards,
 - shadow boards for tools,
 - markings, floor-striping with paint and/or tape.

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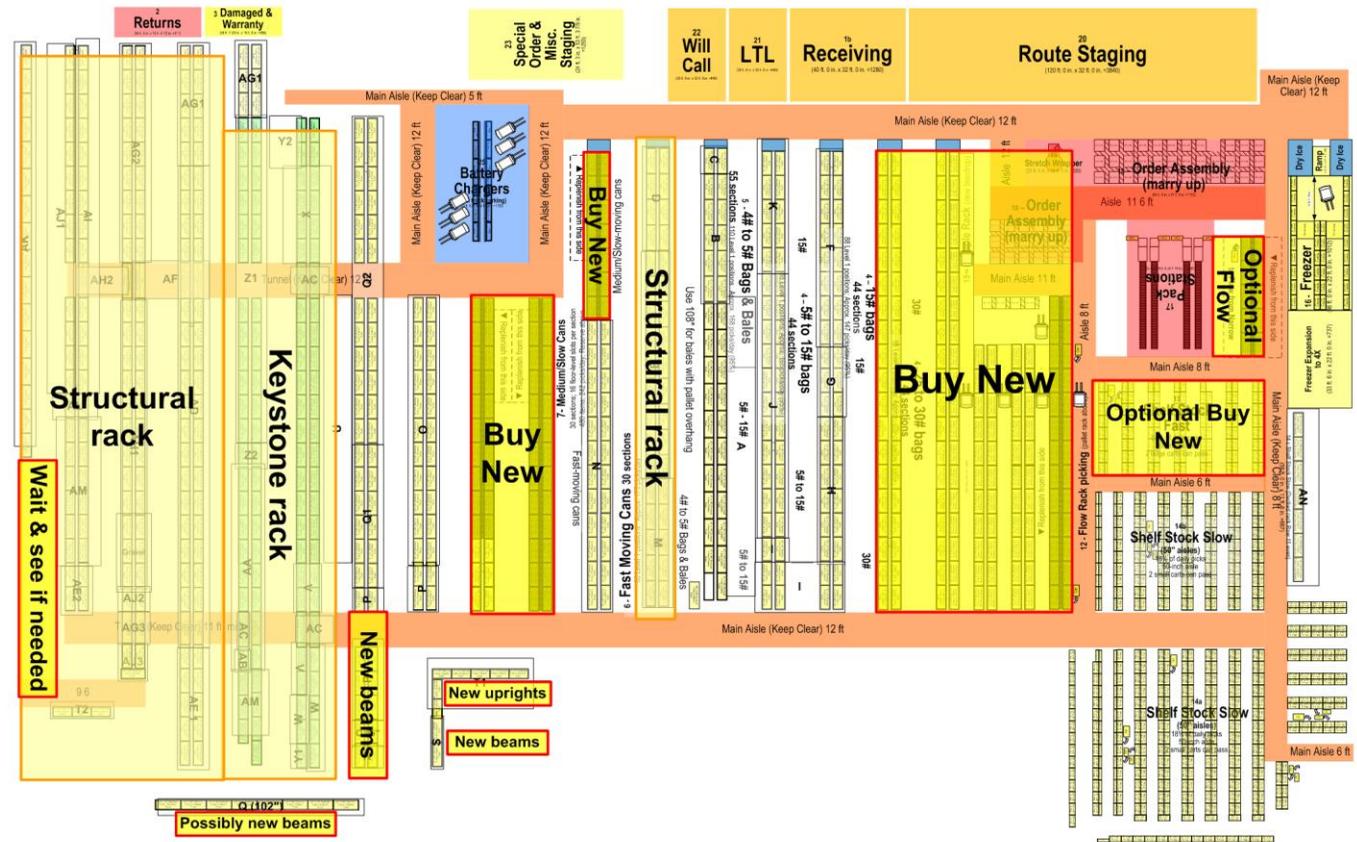
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Notes

Main Points

1. Often, there is a desire to relocate or reconfigure existing storage racks.
2. Such re-use can be complicated if the facility has been in place for many years and the current racks are of several makes or designs.
3. In the example here, the company wants to reuse as much rack as practical when relocating to a larger facility.
4. Current racks include both structural steel (bolted) and roll form. The roll form is of several makes and designs that are not interchangeable. And crossbeams are of two different lengths
5. Because racks are best installed as structures of two back-to-back rows, the planners must map the current rack to the future layout by type and design.
6. Current condition must also be considered as damaged uprights and crossbeams may be beyond or not worth repairing.
7. Given these complications, it is always easier to buy new or reconditioned rack if the budget will allow.

Rack Relocation



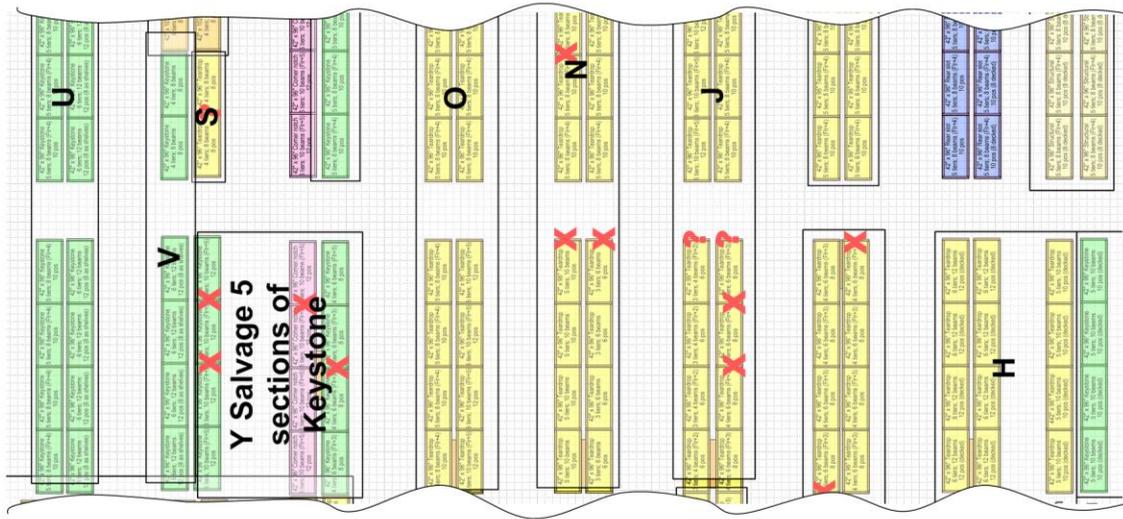
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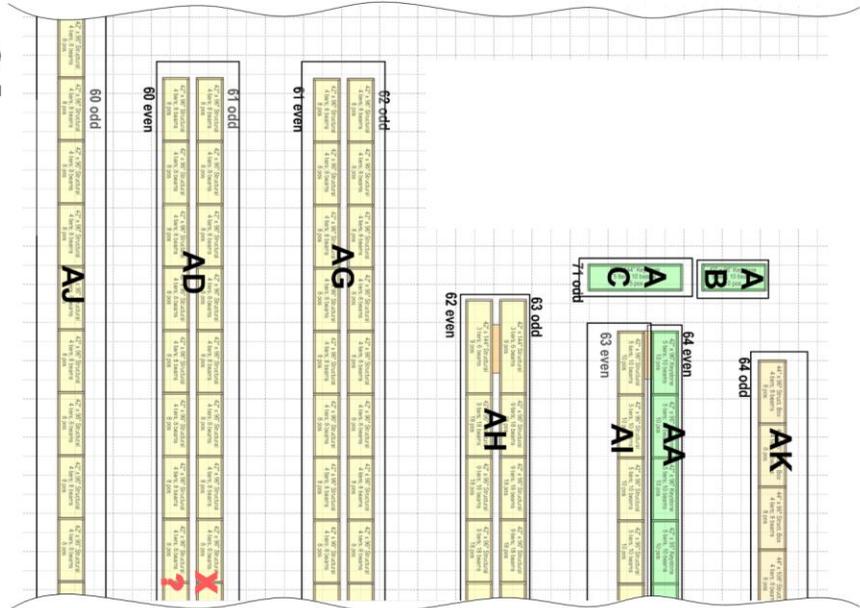
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Rack Relocation

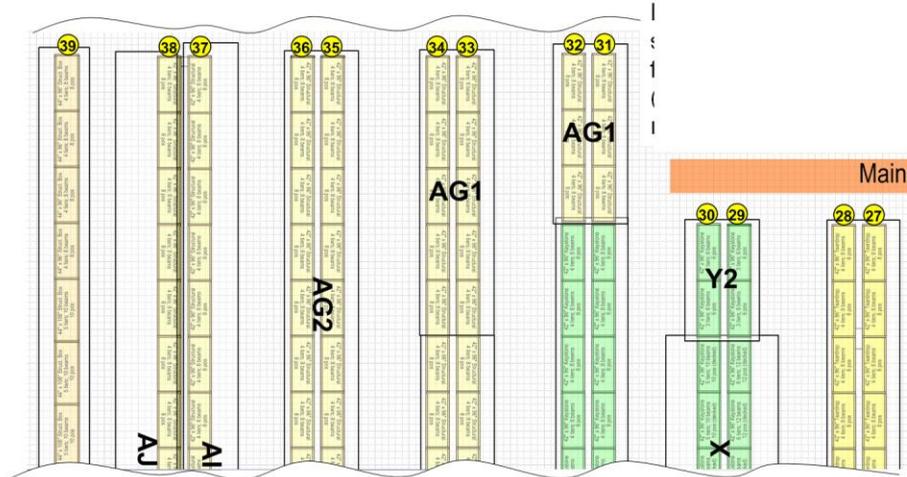
1



2



3



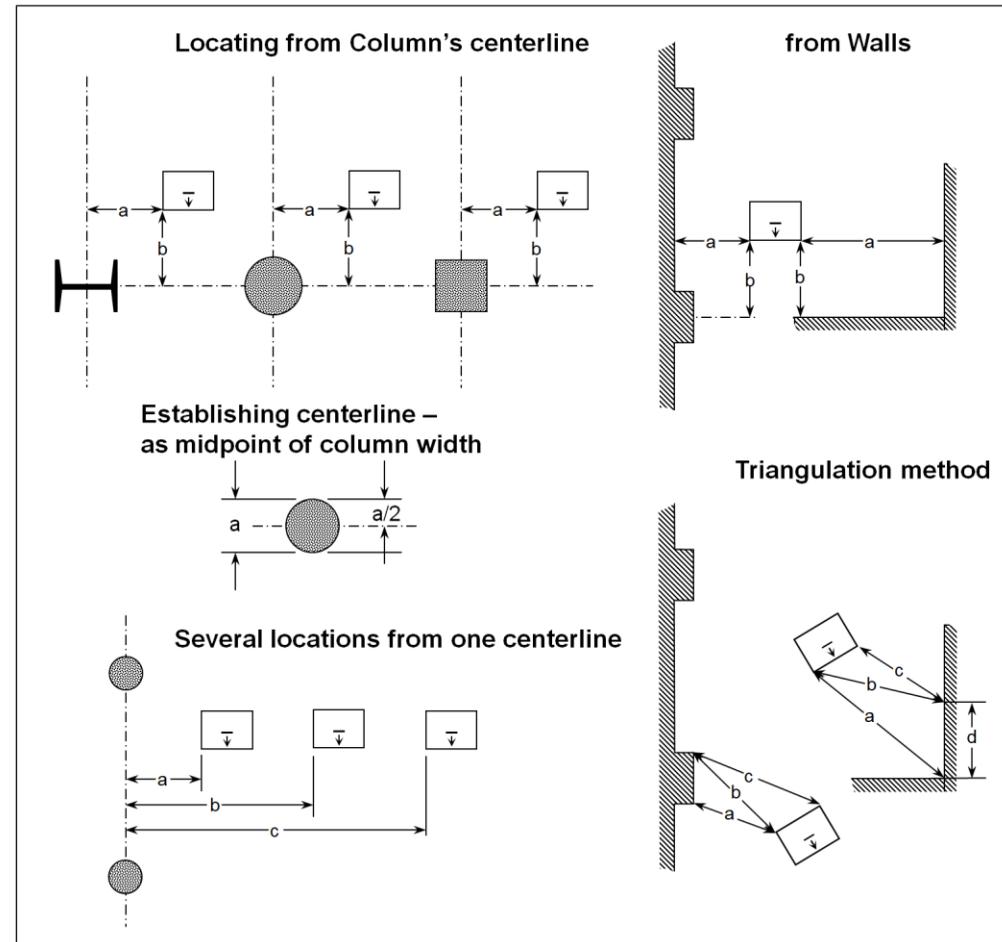
1. Survey of existing racks. Identify type (design) and condition. Each color represents a different design. Each “X” and “?” represents damage.
2. Letters identify rack structures (back to back rows) that can be emptied, taken down, moved, reset and re-filled at new location.
3. Letters identify source structure in current facility for each aisle (numbered circles) in new facility.

Main Points

1. The centerline method is most commonly used in locating equipment. It may be necessary to dimension to both sides of the machine (or machine template) if the reference point is not clearly defined.
2. The use of triangulation requires three dimensions to be specified for proper location of equipment.
3. Machines can also be located from aisle markers as if the measurements were given with respect to a wall. Here, the outside edge of the aisle marker customarily used as the measurement line.
4. Note that for large, interconnected systems such as in automotive body assembly shops, all equipment locations are typically referenced to a single master column. This is because there is too much variability in actual building column placement to use multiple columns as reference points.

Methods of Indicating Machinery & Equipment Placement

1. Centerline method is common.
2. Triangulation needs three dimensions specified for proper equipment location.
3. Aisle markers may be used the same as walls. Usually to outside edge of the aisle stripe.
4. For large, interconnected systems such as in automotive body assembly shops, all equipment locations are typically referenced to a single master column due to dimensional variability of multiple building columns



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8

Notes

Main Points

1. Move Order used in conjunction with a work order system.
2. Each item of machinery or equipment is identified on one line; from and to locations are placed opposite; and instructions entered below.
3. Space at right is for follow-through notes such as installation delays, movers' explanations, and completion sign-off.

Move Notice

| MACHINE & EQUIPMENT MOVE NOTICE | | | | | | |
|--|--|--------------------------------|------------|------------------------------|------|------------------------|
| Plant <u>Mannheim</u> | | Project <u>B-659</u> | | Notice No. <u>633</u> | | |
| Project Description <u>Relocate and Relayout portion of Machine Shop</u> | | | | Work Order No. <u>60-375</u> | | |
| | | | | Prepared by <u>F. Conzen</u> | | |
| Moves to be completed by <u>11/1</u> | | | | Approved by <u>A.J.R.</u> | | |
| | | | | Date Issued <u>5-Oct</u> | | |
| Description | Asset or Tag. No. | (F) -- From: | (T) -- To: | Dept. | Col. | Explanations |
| | Equip. to be moved | Bldg. | Floor | | | Check "OK by" and Date |
| 1 | <i>Brake Press</i> | F | 2 | 44 | D5 | |
| | #1346 | T | 1 | 43 | E8 | |
| 2 | <i>Punch Press</i> | F | 2 | 44 | D5 | |
| | #1113 | T | 1 | 43 | E8 | |
| 3 | <i>Lathe</i> | F | 1 | Receive | A2 | |
| | #1262 | T | 1 | 43 | E8 | |
| 4 | <i>Lathe</i> | F | 2 | 52 | L4 | |
| | #1237 | T | 1 | 43 | D8 | |
| 5 | <i>Lathe</i> | F | 2 | 52 | L4 | |
| | #1238 | T | 1 | 43 | D8 | |
| 6 | <i>Drill</i> | F Dead equipment storage | | | | |
| | #1706 | T | 1 | 43 | D8 | |
| | | Tool Room to recondition | | | | |
| 7 | | F | | | | |
| | | T | | | | |
| 10 | | F | | | | |
| | | T | | | | |
| Instructions: <u>Punch Press #1113. Disconnect electrically after 16:00 on 11/1. Necessary wiring at new location to be done without interruption of service to production line. Installation of this machine to be complete by 07:00 on 11/3.</u> <u>Lathe #1262 (new TOS) -- Move in place and hook up as soon as possible.</u> <u>Lathes # 1237 and 1238 disconnect on 11/8 and be in operation by 11/10.</u> <u>Brake Press #1346 -- Disconnect after 16:00 on 11/6 and in operation by 11/8.</u> | | | | | | |
| Drawing/Plan No. <u>M-2563</u> | | Photo/Sketch No. _____ | | | | |
| Distribution: | | Return to <u>H. Burtzel</u> | | | | |
| | <input checked="" type="checkbox"/> Movers | when installation is complete. | | | | |
| | <input checked="" type="checkbox"/> Maintenance | | | | | |
| | <input checked="" type="checkbox"/> Plant Layout | | | | | |
| | <input type="checkbox"/> File | | | | | |

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9

Notes

Main Points

1. The Installation Instructions Summary is a condensed way of issuing instructions.
2. The item number is keyed to the layout plan for easy reference.
3. Description refers to the equipment being moved.
4. A check or an X in the columns under Utilities indicates services that must be provided or removed.
5. The Electrical column calls out the electrical requirements.
6. The columns labeled Millwrights-Mechanical and Electricians will hold a brief description of the work each trade is to perform.
7. The remainder of the form allows room for instructions or special assignments for other people involved with the installation.

| INSTALLATION INSTRUCTIONS SUMMARY | | | | | | | | | | | | | | | | | |
|-----------------------------------|--------------------------------|----------------------------|-----------|-------|-----|-------|------|-----------------------------------|--------------------|-------|---------|-------------------|------|--------------|---------------------------------------|--------------------------------|------|
| Description | | <i>Relayout of Kitchen</i> | | | | | | Plant | <i>Nortot</i> | | Project | <i>343</i> | | | | | |
| | | | | | | | | By | <i>O.M. Cramer</i> | | With | <i>D.F. Addis</i> | | | | | |
| | | | | | | | | Date | <i>11/10</i> | | Sheet | <i>2 of 2</i> | | | | | |
| ITEM No. | DESCRIPTION MACH./EQPT. No. | MOVE | UTILITIES | | | | | MILLWRIGHTS-MECHANICAL | ELECTRICAL | | | | | ELECTRICIANS | OTHER WORK -- (Code who and describe) | | |
| | | | Air | Water | Gas | Drain | Vent | | Steam | Volts | Phase | KVA | Amps | | H.P. | WHO | WHAT |
| 1 | Sink D-1 | - | - | ✓ | - | ✓ | - | Reorient | | | | | | | | | |
| 2 | Food Prep. Table D-2 | A-5 B-10 | - | - | - | - | - | Relocate | 110 | | | 15 | | Install | C | Revise table per drawing T6538 | |
| 3 | Steamer (Stag) D-3 | A-5 B-10 | - | ✓ | ✓ | ✓ | ✓ | Relocate | 110 | | | 15 | | Hook up | | | |
| 4 | Proof Box D-4 | A-7 B-10 | - | - | - | - | - | Relocate after repairs | 110 | | | 15 | | Install | | | |
| 5 | Bake Oven D-5 | A-7 B-10 | - | - | ✓ | - | ✓ | Relocate | | | | | | | F | Check for fire regulations | |
| 6 | Portable Mixer D-6 | A-7 B-10 | - | - | - | - | - | Relocate | 110 | | | 15 | | Install | | | |
| 7 | Range F-7 | C-5 B-12 | - | ✓ | ✓ | - | ✓ | Relocate | | | | | | | F | Check for fire regulations | |
| 8 | Range F-8 | C-5 B-12 | - | ✓ | ✓ | - | ✓ | Relocate | | | | | | | F | Check for fire regulations | |
| 9 | Portable Slicer F-10 | C-5 B-12 | - | - | - | - | - | Relocate | 110 | | | 15 | | Install | S | Certify present guards | |
| 10 | Exhaust Hood | - | | | | | ✓ | Rearrange and tie-in with 3,5,7,8 | | | | | | | | | |
| 11 | Partition | A-5 76 | | | | | | | | | | | | | C | Disassemble and salvage | |

RICHARD MUTHER & ASSOCIATES - 315 To accompany Drwg. Nos. **M-29548** Work Order **60-936**

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10

Notes

Main Points

1. For routine and small rearrangements, a standard “checklist” worksheet like this one may be sufficient for planning and managing installation.
2. For more complex projects a Gantt chart is preferred.
3. Installation Coordination Worksheet is used to assign responsibilities and check status of installation planning.
4. This sheet shows the timing established for each step in coordinating a move.
5. Along with the due times go assignments to specific individuals for the completion of each step.
6. A status report is issued periodically (information on the right side of the form) to prevent detail "fall downs" from affecting the completion date scheduled for the entire project.

Installation Coordination Worksheet

| WHAT | | WHO | WHEN | STATUS | As of (date) |
|-----------------------|---|-----------|-------|----------------|--------------|
| PLAN | 1. Start planning the installation | J. Heller | 8/20 | Complete | 10/2 |
| | 2. Establish sequence and timing of moves | J. Heller | 8/20 | Complete | 10/2 |
| | 3. Inventory materials and equipment to move | H. Dunlap | 8/20 | Complete | 10/2 |
| | 4. Get disposition of non-moving material and equipment | V. Daniel | 8/26 | Complete | 10/6 |
| | 5. Schedule moves in detail | J. Heller | 9/10 | Complete | 10/2 |
| | 6. Assign move numbers: check vs inventory & equipment (tag) number | J. Heller | 9/20 | Complete | 10/2 |
| | 7. Verify procedural changes and timing (a) | na | na | | |
| MAKE READY PROVIDE | 1. Decide who will make moves | C. Jacks | 10/5 | Complete | 10/2 |
| | 2. Secure bids as necessary | A. Printz | 8/20 | Complete | 10/2 |
| | 3. Determine and reserve moving equipment required | A. Printz | 9/10 | Complete | 10/6 |
| | 4. Set up communications for both ends of move | J. Heller | 11/2 | | |
| | 5. Appoint key person for each area | D. Bell | 10/10 | Complete | 10/6 |
| | 6. Get work order(s) for moves | C. Jacks | 10/10 | By 10/20 | |
| | 7. Verify delivery for any new equipment (b) | na | na | | |
| PREPARE | 1. Prepare new locations -- physical area, conditions, auxiliaries | C. Jacks | 10/20 | | |
| | 2. Broadcast plans | Z. White | 10/10 | Briefing 10/26 | |
| | 3. Brief personnel specifically involved | Z. White | 10/10 | Briefing 10/26 | |
| | 4. Mark everything to move: identification, move no., destination | J. Heller | 10/15 | Resched 11/3 | |
| | 5. Disconnect or ready equipment | C. Jacks | 10/27 | | |
| | 6. Check out equipment and release to movers | J. Heller | 10/27 | | |
| | 7. Complete required training (c) | V. Daniel | 10/30 | | |
| DO INSTALL | 1. Move equipment intact to reduce re-assembly time | C. Jacks | 11/10 | | |
| | 2. Move close to spot to reduce line-up and hook-up time | C. Jacks | 11/10 | | |
| | 3. Post move performance as accomplished | C. Jacks | 11/10 | | |
| | 4. Keep moving crew informed, coordinated | C. Jacks | 11/10 | | |
| | 5. Be on hand -- layout interpretation | J. Heller | 11/10 | | |
| | 6. Be on hand -- auxiliaries interpretation | J. Heller | 11/10 | | |
| | 7. Be on hand -- procedures interpretation (a) | na | na | | |
| HOOK-UP | 1. Spot equipment check location | J. Heller | 11/10 | | |
| | 2. Temporary hook-ups where needed | J. Heller | 11/10 | | |
| | 3. Check and release for permanent connections | C. Jacks | 11/10 | | |
| | 4. Inspect the installation & release for tryout | C. Jacks | 11/12 | | |
| | 5. Maintenance tryout | C. Jacks | 11/13 | | |
| | 6. Release to operating group; secure acceptance | J. Heller | 11/14 | | |
| | 7. | | | | |
| PUT AWAY CLEAN-UP | 1. Survey-inspect old and new areas | C. Jacks | 11/15 | | |
| | 2. Schedule & assign clean-up -- old and new areas | C. Jacks | 11/18 | | |
| | 3. Verify layout as installed | J. Heller | 11/18 | | |
| | 4. Verify auxiliary service as installed | J. Heller | 11/18 | | |
| | 5. Verify or adjust layout & service-specification records | J. Heller | 11/20 | | |
| | 6. Recap installation costs and performance | J. Heller | 11/25 | | |
| | 7. Final sign-off by operating group | V. Daniel | 11/25 | | |

Reference Notes:
a. No changes in operating procedures or work instructions
b. No new machinery, just rearrangement
c. Walk operators through mock-up of planned new layout.
d.

RICHARD MUTHER & ASSOCIATES - 310 MAY BE REPRODUCED FOR IN-COMPANY USE PROVIDED ORIGINAL SOURCE IS NOT DELETED

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Notes

Main Points

1. A periodic progress record informs the various interested parties of the progress being made on each layout installation project.
2. Each project is listed as an aid in keeping the layout planners and the layout installers (in this case Process Engineering) moving along together.
3. Projects falling behind can be highlighted; the cause of delay and the party responsible for corrective action can be identified and reported.

COORDINATION AND PROGRESS SUMMARY

Covering Qingzhou #4 Status as of 6-1 Originating Department Process Engineering
 Distribution Tang, Hao, Ito, Gordon, Chen (2), File Reported by LH Prepared by R. Jin
 Date 5/1 Sheet 1 of 1

| Task/Project. No. and/or Description | Resp. Dept. | Status Code | Status & Remarks |
|--|---------------|-------------|---|
| Work to do; Action to be taken | | | |
| 1 M-121 Bracket Line Rebalancing | Process Engr. | 1 | Delay due to flooding of area. |
| 2 M-126 Hermetic Winding & Assembly | Plant Engr. | 4 | Maintenance still waiting on shaping press. Need drinking fountain. |
| 3 M-128 Consolidate Core Iron Shearing | Plant Engr. | 3 | Bridge crane electrification complete. On schedule. |
| 4 M-129 Relayout Large Motor Department | Process Engr. | 1 | |
| 5 M-133 Relayout Auto. Screw Machine Dept. | KPO | 0 | Scheduled to begin planning August 1. |
| 6 M-134 Air Brake Assembly and Storage | Plant Engr. | 3 | New test benches on valve line to replace obsolete temporary benches. |
| 7 M-137 W-1996 Washer from D-46 to D-40 | Plant Engr. | 3 | Equipment installed. Adjustment still required. |
| 8 M-138 Move W-6922 Press | Safety | 4 | Installation complete -- waiting on approval from safety engineer. |

| | | | |
|--|--|--|--|
| | | | |
|--|--|--|--|

Status Code: _____ NOTES: _____
 0, Not yet begun; 1, Preliminaries underway; 2, Prelim. Complete & work in process; 3, Well along; 4, Almost done; Compl., Complete

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Notes

Here's What I Know

| Question | Which Answer Is (Most) Correct | Got It |
|--|--|--------|
| 1. In Systematic Layout Planning (SLP), the meaning of Phase IV – Installation includes: | <ul style="list-style-type: none"> A. Planning and scheduling the installation B. Managing the installation as it occurs C. Physical installation of equipment D. All of the above | |
| 2. The Installation phase of a layout project may also include: | <ul style="list-style-type: none"> A. Repair, rebuild, or repaint equipment. B. Initiate new working methods, procedures, controls. C. Convert to new materials or new product specifications. D. Incorporate better safety practices. E. Repair the floors, walls, ceilings, and do other major maintenance work. F. Realign supervisory responsibilities. G. Housekeeping; removal of unnecessary items from the floor. H. Any or all of the above | |
| 3. Standard checklists and sign-off sheets help to manage complex installations. | <ul style="list-style-type: none"> A. True B. False. | |