

Plumbing



Plumbing

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Acknowledgments

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U. S. Job Corps U.S. Department of Labor
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Workplace Skills for the Secretary's Commission on Achieving Necessary Skills.
21st Century

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Overview

Vocational training programs in Iraq are faced with many challenges. Iraq needs a speedy reconstruction and the Iraqi people need a future with the promise of employment and prosperity.

This training will combine occupational skills with technical knowledge and will be competency based. We will customize training to meet employer demands, cultural differences, geographic location, and needs of the trainees. The technical approach is modeled after the U.S. Department of Labor, Employment and Training Administration, Office of Job Corps training model. This curricula is competency-based, meaning that the student actually demonstrates a competency in practice and assessments. The Job Corps vocational training curricula consist of competency objectives with corresponding lessons and tasks or skill assignments. Following completion of each level of difficulty or assigned task, assessment tools determine competency and will help with evaluation and remediation. The competency-based instructional programs will:

- ▶ Assess the trainee's needs, including strengths and weaknesses
- ▶ Select appropriate instructional goals based on the needs assessment
- ▶ Provide trainee-centered instruction aimed at the instructional goals
- ▶ Evaluate to determine if the trainee has mastered the goals and can apply them

The instructional design (competency-based) will let the trainees demonstrate competency for the skills they already have and then begin instruction at the point where competency is not demonstrated. From there, the trainee will progress through the competencies listed on a Training Achievement Record until they complete training and are prepared to work.

These instructional materials include a Training Achievement Record (TAR). TARs list each competency required for the trade grouped by skill type. The curricula also include sample lesson plans. The curricula will provide for development in general areas prior to competency in more specific trade areas. This allows those who are not able to complete an entire program to develop skills suitable for lower levels of employment.

This curriculum has been developed in collaboration with MOLSA instructors, Job Corps training experts, and other technical professionals. It was created for use in all MOLSA vocational technical training centers that educate and train students to become competent, entry-level plumbing technicians. This curriculum will provide instructors with the necessary ingredients for a complete plumbing program. The purpose of this guide is to establish a common language of proficiency standards so that both the Vocational Technical Training Centers and industry have a universal set of standards for plumbing programs.

This curriculum has been developed for use by all Iraq Vocational Technical Training Centers that offer programs in plumbing technology. Because of the great diversity among the different regions of the country, this curriculum was designed, to be a flexible document that allows for the differences in instructor methodology. There are also differences in the length of programs and differences in equipment at some of the MOLSA centers. All content areas and competencies must be integrated into the training center plumbing curricula so that students become competent in those areas.

This curriculum does not offer a step-by-step formula for teaching a plumbing course. This guide is designed to facilitate the classroom work of plumbing instructors but not to replace the decision-maker.

This curriculum has been aligned to modules in the Contren Learning Series as endorsed by the National Center for Construction Education and Research (NCCER). Students who successfully pass this course may be certified by MOLSA and will receive documentation from MOLSA.

It is the instructor who organizes instructional materials for effective and efficient learning. And **it is the instructor** who integrates the latest teaching technologies into his or her classroom. It is in support of these professionals and of their students that this curriculum has been developed.

Each vocational course consists of a series of instructional units which focus on a common theme. All units have been written using a common format which includes the following components:

- Module Number and Title (TAR Skill Set)
- Suggested Time to Train on Skill Set - An estimated number of clock hours of instruction that should be required to teach the competencies and objectives of the module. The curriculum framework should account for approximately 75-80 percent of the time in the course.
- Competencies and Objectives
 - A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a module. The student, instructor and worksite supervisor (if applicable) will evaluate and record a pre-training mastery level for all skill sets, as well as a post-training mastery level review.
 - The outcomes represent the enabling and supporting knowledge and demonstrated performances that will indicate mastery of the competency at the course level.

- Teaching Strategies - This section of each unit indicates strategies that can be used to enable students to master each competency. Emphasis has been placed on strategies which reflect active learning methodologies. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.
- Suggested Assessment Strategies - This section indicates strategies that can be used to measure student mastery. Examples of suggested strategies could include rubrics, class participation, reflection, and journaling. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources, however, the only required assessment is completion of the TAR checklist.
- References - A list of suggested references is provided for each unit in the appendix. The list includes some of the primary instructional resources that may be used to teach the competencies and suggested outcomes. Again, these resources are suggested and the list may be modified or enhanced based on needs and abilities of students and on available resources.

Table of Contents

Acknowledgements	2
Overview	3
Vocational Training Description	7
Course Outline	8

Plumbing

Module 1:	Employability Skills.....	9
Module 2:	Math.....	11
Module 3:	Pipe Cutting and Joining.....	12
Module 4:	Plumbing System Installation.....	13
Module 5:	Plumbing System Testing.....	15
Module 6:	Maintenance and Repair.....	16

Appendix A:	TAR Evaluation Checklist
Appendix B:	Workplace Skills for the 21st Century
Appendix C:	Suggested References
Appendix D:	Recommended Tools and Equipment

Vocational Training Description

The Plumber program prepares a student for entry level employment in plumbing technology courses and/or for further study at the postsecondary level emphasis is an employability skills math pipe cutting and joining plumbing system installation, plumbing system testing and maintenance and repair.

The content of the plumbing training curriculum framework follows the recommended national standards for the U.S. office of the Job Corps.

Course Outline

<i>Module</i>	<i>Title</i>	<i>Hours</i>
Module 1:	Employability Skills.....	10.0 hours
Module 2:	Math.....	200.0 hours
Module 3:	Pipe Cutting and Joining.....	200.0 hours
Module 4:	Plumbing System Installation.....	200.0 hours
Module 5:	Plumbing System Testing.....	80.0 hours
Module 6:	Maintenance and Repair.....	200.0 hours
<i>Total</i>		<i>890.0</i>

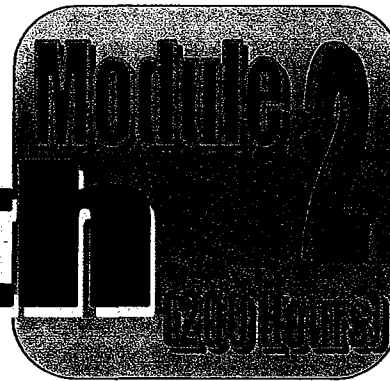
Employability Skills



Competencies and Outcomes	Strategies for Competencies
1. Employability Skills. <ul style="list-style-type: none"> a. Demonstrate the ability to dress appropriately for work. b. Demonstrate the ability to arrive for work on time. c. Demonstrate the ability to respond appropriately to supervision. d. Demonstrate the ability to follow directions. e. Demonstrate the ability to listen effectively. f. Demonstrate the ability to ask for clarification when further information is required. g. Demonstrate the ability to share information and explain procedures to another person. h. Demonstrate the ability to take initiative. i. Demonstrate the ability to satisfy customers. j. Demonstrate the ability to work as a member of a team. k. Demonstrate the ability to work harmoniously with diverse races, sexes, ages and cultures. 	Teaching: <ul style="list-style-type: none"> • Define trade terms related to basic employability skills. • Students will interview individuals in the PLUMBING industry. Students will be provided questions by the instructor; the student will write a report on the interview and present the report to the class. • Use the Contren Series Core text, Basic Employability Skills Unit related to basic skills. • Introduce the Job Corps Employability skills. Assessment: <ul style="list-style-type: none"> • Assess student understanding through instructor observations and written unit test. • Validate mastery of the skillsets using the TAR Checklist.

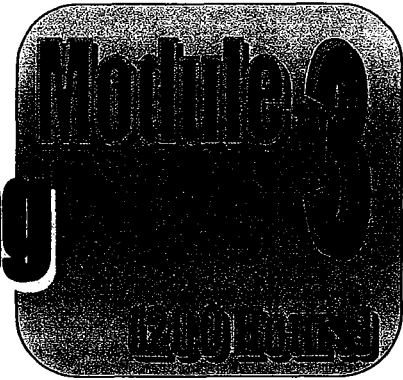
<ul style="list-style-type: none">l. Demonstrate the ability to troubleshoot and solve problems.m. Demonstrate the ability to access and use information from manuals and computer.n. Demonstrate the ability to maintain good Hygiene.o. Demonstrate the ability to stay on task.p. Demonstrate the ability to maintain tools and equipment properly.	
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Math



Competencies and Outcomes	Strategies for Competencies
1. Math <p>a. Calculate the slope required for building and sewer lines.</p> <p>b. Scale blueprints.</p>	Teaching: <ul style="list-style-type: none"> • Discuss and describe the functions of water sewage systems and how they work. • Discuss the importance of proper slope for building and sewer lines. • Explain how waste moves from a fixture through the drain system to the environment. • Identify and set-up a level and/or transit. • Set up the level/transit, shoot elevations and grade pipe. • Identify and interpret various symbols, notes, and terms. • Identify, interpret and locate details on piping and structural blueprints. • Interpret dimensions and symbols. • Sketch various pipes and piping drawings. Assessment: <ul style="list-style-type: none"> • Validate mastery of the skillsets using the TAR Checklist.

Pipe Cutting and Joining



Competencies and Outcomes	Strategies for Competencies
1. Pipe Cutting and Joining <ul style="list-style-type: none"> a. Join pipe (tubing) to fitting using brazing method. b. Cut pipe with cut off/chop saw. c. Join C.I. no-hub pipe with no-hub couplings. d. Join hub and spigot C.I. pipe with Neoprene gaskets. 	Teaching: <ul style="list-style-type: none"> • Identify the various types of tubing and describe the common types of fittings. • Explain the safe use of tools and equipment. • Identify the proper tools and explain the use of the equipment for each specific task. • Describe and fabricate various pipe assemblies. • Prepare different types of pipe for fabrication. Assessment: <ul style="list-style-type: none"> • Validate mastery of the skillsets using the TAR Checklist.

Plumbing System Installation



Competencies and Outcomes	Strategies for Competencies
1. Plumbing System Installation <ol style="list-style-type: none"> Rough-in DWV systems for a full bath. Install water distribution systems for a full bath. Install gas piping for water heater and furnace. Install water closet carrier and set stool. Install electric hot water heaters. Install hot water heaters. 	Teaching: <ul style="list-style-type: none"> Explain the procedures and install bathroom fixtures according to code. Explain and install a tub, bidet, water closet, and lavatory. Explain the procedures for the installation and rough-in used in a full bath. Define and explain back flow requirements and systems. Identify/explain the various laws pertaining to gas installation requirements. Identify approved joints and connections for gas water heaters. Explain the procedures for installing a water closet carrier and set stool. Identify and explain safety procedures. Identify and explain the parts of a water heater. Identify and describe temperature and pressure valves.

	<ul style="list-style-type: none"> • Install a hot water heater, including T & P valves. • Construct a venting system for hot water heaters. <p>Assessment:</p> <ul style="list-style-type: none"> • Validate mastery of the skillsets using the TAR Checklist.
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Plumbing System Testing



Competencies and Outcomes	Strategies for Competencies
<p>1. Plumbing System Testing.</p> <ul style="list-style-type: none"> a. Pressure test water distribution system/air/hydro. b. Make water tests on building drains. c. Locate leaks in gas supply using soapy water. 	<p>Teaching:</p> <ul style="list-style-type: none"> • Discuss and perform required tests on water distribution systems. • Discuss and perform required tests on building drainage systems. • Discuss and perform leak tests on gas supply lines <p>Assessment:</p> <ul style="list-style-type: none"> • Validate mastery of the skillsets using the TAR Checklist.

Maintenance and Repair

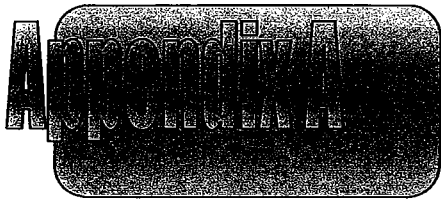


Competencies and Outcomes	Strategies for Competencies
1. Maintenance and Repair <ol style="list-style-type: none"> Remove obstructions from main drain lines using power drain cleaner (cleaning machine). Repair leaking water faucet or valves. Repair tank water closet. Repair and adjust flush meter valves. (Sloan Valve) Free jammed garbage disposal. Replace thermocouple. Replace electric water heater element high, limit shut-off and thermostat. 	Teaching: <ul style="list-style-type: none"> Discuss and demonstrate the safe and proper use of various drain cleaning machines. Identify, explain and demonstrate techniques for repairing leaking water faucet or valves. Explain and demonstrate procedures for repairing tank type water closet. Explain and demonstrate procedures for repairing and adjusting flush meter valves. (Sloan Valves) Discuss and demonstrate proper method of freeing jammed garbage disposal. Discuss safety precautions. Identify and replace a thermocouple. Identify and explain safe procedures. Identify and explain parts of a water heater. Identify and describe temperature and pressure valves.

Training Guidelines

Plumbing

	Assessment: <ul style="list-style-type: none">• Validate mastery of the skillsets using the TAR Checklist.
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TAR

(Training Achievement Record)

Evaluation Checklist for Plumbing

Directions for Completing TARs

A. When the student performs a task listed in the "DUTIES AND TASKS" column, the instructor should rate the student's level of performance by circling a, b, or c in the "PERFORMANCE RATING" column.

RATING

a - Proficient and able to teach others	The student consistently performs the task accurately without supervision. The student possesses sufficient skill to teach the task to others.
b - Proficient	The student performs the task to industry standards with little or no supervision. This is the minimum performance rating for TAR skill completion.
c - Exposed/not proficient	The student has been introduced to the task, but cannot perform the task to industry standards.

1. If the student performs the task at a level c, circle the number in pencil so that it can later be erased and entered permanently as b or a when the student improves his/her performance. A performance level of b is satisfactory (passing) and can be entered permanently or, at the instructor's discretion, circled in pencil to allow the student to improve his/her performance at a later date.
2. When the student performs the task to the instructor's satisfaction, (at a level of b or a) circle the appropriate performance rating, and enter the date in the "DATE COMPLETED" column. The instructor and student should initial the DUTY area when **all the tasks** in that duty area are completed.

B. When the student completes the TAR or terminates the program before completing the TAR, the instructor must finalize the TAR by doing the following:

1. Check the appropriate box and enter the date that the student completed the TAR or terminated the training program in the space provided at the top of page 1:

☐ Completed or ☐ Terminated Training: _____
Date



PLUMBER

TRAINING ACHIEVEMENT RECORD (TAR) FOR:

Name: _____

IDN: _____

Date Entered Training: _____

☐ Completed or ☐ Terminated Training: _____
Date

CENTER'S NAME: _____

Address: _____

Phone: _____

Instructor: _____

DUTIES AND TASKS	PERFORMANCE RATING	DATE COMPLETED	INSTRUCTOR'S INITIALS	STUDENT'S INITIALS
A. EMPLOYABILITY SKILLS				
1. Demonstrate the ability to dress appropriately for work.	a b c *			
2. Demonstrate the ability to arrive for work on time.	a b c			
3. Demonstrate the ability to respond appropriately to supervision.	a b c			

* a - Proficient and able to teach others;

b - Proficient;

c - Exposed/not proficient

DUTIES AND TASKS	PERFORMANCE RATING	DATE COMPLETED	INSTRUCTOR'S INITIALS	STUDENT'S INITIALS
4. Demonstrate the ability to follow directions.	a b c			
5. Demonstrate the ability to listen effectively.	a b c			
6. Demonstrate the ability to ask for clarification when further information is required.	a b c			
7. Demonstrate the ability to share information and explain procedures to another person.	a b c			
8. Demonstrate the ability to take initiative.	a b c			
9. Demonstrate the ability to satisfy customers.	a b c			
10. Demonstrate the ability to work as a member of a team.	a b c			
11. Demonstrate the ability to work harmoniously with diverse races, sexes, ages and cultures.	a b c			
12. Demonstrate the ability to troubleshoot and solve problems.	a b c			
13. Demonstrate the ability to access and use information from manuals and computers.	a b c			
14. Demonstrate the ability to maintain good hygiene.	a b c			
15. Demonstrate the ability to stay on task.	a b c			
16. Demonstrate the ability to maintain tools and equipment properly.	a b c			
B. MATH				
1. Calculate the slope required for building and sewer lines.	a b c			
2. Scale blueprints.	a b c			
C. PIPE CUTTING AND JOINING				
1. Join pipe (tubing) to fitting using brazing method.	a b c			
2. Cut pipe with cut off/chop saw.	a b c			
3. Join C.I. no-hub pipe with no-hub couplings .	a b c			
4. Join hub and spigot C.I. pipe with Neoprene gaskets.	a b c			

* a - Proficient and able to teach others;

b - Proficient;

c - Exposed/not proficient

DUTIES AND TASKS	PERFORMANCE RATING	DATE COMPLETED	INSTRUCTOR'S INITIALS	STUDENT'S INITIALS
D. PLUMBING SYSTEM INSTALLATION				
1. Rough-in DWV systems for a full bath.	a b c			
2. Install water distribution systems for a full bath.	a b c			
3. Install gas piping for water heater and furnace.	a b c			
4. Install water closet carrier and set stool.	a b c			
5. Install electric hot water heaters.	a b c			
6. Install hot water heaters.	a b c			
E. PLUMBING SYSTEM TESTING				
1. Pressure test water distribution system/air/hydro.	a b c			
2. Make water tests on building drains.	a b c			
3. Locate leaks in gas supply using soapy water.	a b c			
F. MAINTENANCE AND REPAIR				
1. Remove obstructions from main drain lines using power drain cleaner(cleaning machine) .	a b c			
2. Repair leaking water faucet or valves.	a b c			
3. Repair tank type water closet.	a b c			
4. Repair and adjust flushmeter valves (Sloan Valve).	a b c			
5. Free jammed garbage disposal.	a b c			

* a - Proficient and able to teach others;

b - Proficient;

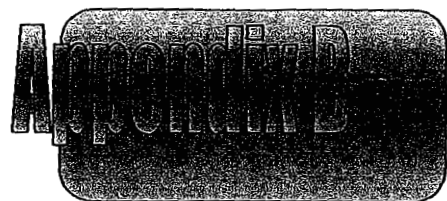
c - Exposed/not proficient

DUTIES AND TASKS	PERFORMANCE RATING	DATE COMPLETED	INSTRUCTOR'S INITIALS	STUDENT'S INITIALS
6. Replace thermocouple.	a b c			
7. Replace electric water heater element, high, limit shut-off and thermostat.	a b c			
G. EMPLOYER SPECIFIC SKILLS				
1.	a b c			
2.	a b c			
3.	a b c			
4.	a b c			
5.	a b c			

* a - Proficient and able to teach others;

b - Proficient;

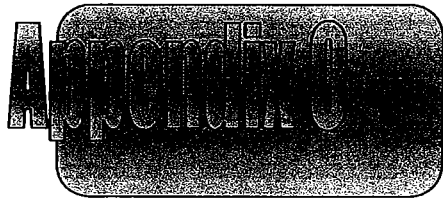
c - Exposed/not proficient



Workplace Skills for the 21st Century for Plumbing

Workplace Skills for the 21st Century for All Modules

- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

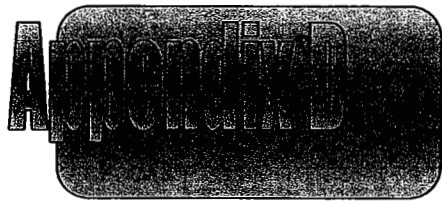


Suggested References

Suggested References for all modules

Kibbe, R. (2002). *Mechanical systems for industrial maintenance*. Upper Saddle River, NJ: Pearson Prentice Hall.

National Center for Construction Education and Research. (2002). *Construction technology volume I*. Upper Saddle River, NJ: Pearson Prentice Hall.



Recommended Tools & Equipment

ITEM	المواد	QTY
Screw spanner sizes (14,12,10,8,and 2.5 inch)	سبانة براغي بالأحجام 2.5 و 8 و 10 و 12 و 14 انج	36
Kindek (nut opener)sizes (12,10 and 8 inch)	كندك بالأحجام 8 و 10 و 12 هنج	8
Metal saw size (0.5- 2 inch)	منشار حديد بالقياسات 2/1 - 2 انج	12
Round headed hammer(1 pound)	مطرقة مدورة الرأس 1 لييرة	6
Pipe vice size (0.5- 2 inch)		6
Large square hammer	مطرقة كبيرة مربعة الرأس	6
Small square hammer	مطرقة صغيرة مربعة الرأس	6
Pipe screw tooth maker size	دايس	6
Electrical automatic screw tooth maker (0.5- 2 inch)	دايس كهربائي حجم 2/1 - 2 انج	2
Large Hammer drill with bits	همر دريل كبير مع براين	3
Electrical sander fixed type	رندة كهربائية ثابتة	2
Hydraulic pipe bender	لاوية أنابيب هيدروليكية	1
Galvanized pipe (0.5- 3. 4-1)	انابيب مغلوقة قياس 2/1 و 4/3 و 1 انج	58
Galvanized L joint (0.5)	عكس 2/1 انج	240
Inverted adapter (0.5)	تحويلة عكس (سبيل) 2/1	240
Three point distributor(0.5)	تقسيم 2/1 انج	240
Pipe nut (0.5)	صامولة 2/1 انج	240
Connector (0.5)	يونية 2/1 انج	240
Sink mixer taps	خلاط سنك	6
Wash basin mixer tap	خلاط مغسلة	6
Water locked tap 0.5 inch	قفل 2/1 انج	6
Galvanized L joint - 1 inch	عكس 1 انج	120
Inverted adapter 1 inch	سبيل 1 انج	120
Three point distributor - 1 inch	تقسيم 1 انج	120

Extender - 1 inch	موسع 1 انج	120
Tank float (0.75 inch), (0.5 inch) 1/2	طوافة 2/1 و 4/3 انج	12
Pipe nut 1 or (0.5 inch)	صامولة 1 أو 2/1 انج	12
Pipe nut 1 or (0.75 inch)	صامولة 1 أو 4/3 انج	12
Adapter connector size 0.75 or 0.5, 1* 0.5, 1* 0.75 inch	خزان ماء	41
Water tank size 90 cm* 60 cm 90x 60		12
Teflon tape	تيفلون	224
Wash basin plastic pipe 1	نبوب بلاستيك للمغسلة	50
Wash basin complete	مغسلة كاملة	5
Sink	سناك	5
Electrical water heater	سخان كهربائي	3
Eastern WC Base	مرحاض شرقي	5
Gully plastic 4 inch	كلي بلاستيكي 4 انج	20
Iron pencils diff. Sizes	أقلام حديد متعددة القياسات	12
Pipe 0.5 inch	أنبوب قياس 2/1 انج	100
Pipe 0.75 inch	أنبوب قياس 4/3 انج	100
Pipe 1 inch	أنبوب قياس 1 انج	50
joint 0.5 inch	جوين 2/1 انج	500
joint 0.75 inch	جوين 4/3 انج	500
Inverted Adapter 0.5 inch	تحويلة معكوسة 2/1 انج	215
Inverted Adapter 0.75 inch	تحويلة معكوسة 4/3 انج	215
Three point distributor 0.5 inch	تقسيم 2/1 انج	500
Three point distributor 0.75 inch	تقسيم 4/3 انج	500
Distributor 0.75- 0.5 inch	موزع 4/3 - 2/1 انج	58
Western WC base	مقعد مرحاض غربي	5

Siphon	سيفون	23
Shower	دوش	12
Shower Mixer	خلاط دوش	12
Sewerage Pipes 4 inch	انابيب مجاري 4 انج	20
Sewerage Pipes 3 inch	انابيب مجاري 3 انج	20
Main hall 30cm + 30 cm	منهول 30سم + 30سم	12
Main hall 50cm + 50 cm	منهول 50سم + 50سم	7
Helen pistol to fix concrete nails		1
Complete power driver threading machine rigid 300 plus attachments	ماكينة عمل أسنان ثابتة مع الملحقات	1
Tri-stand vise with chain type vise	منكنة ذات سلسلة مع قاعدة ثلاثية	6
Exposed ratchet drop head threaded with dies ½"-2"	سيت دايس (2-2/1) انج مع القفل	2
3/8" h.d. variable speed reversing drill motor	متقب ذو سرع مختلفة حجم 8/3 انج	6
½" h.d. right angle drill motor	متقب قائم الزاوية حجم 2/1 انج	1
Plumber's kit	عدة السباك	12
1-1/2"Electric demolition hammer -TF-52HILTY	همر كهربائي (مطرقة) قياس (1 2/1) انج	1
Portable electric reciprocating saw/Porta Band Electric Hack Saw	منشار كهربائي ترددي محمول	2
7-1/4" Portable electric circular saw	منشار كهربائي دائري متحرك قياس (7 4/1) انج	1
Tap and die set (standard)	سيت عمل الأسنان الداخلية والخارجية قياس ثابت	1
10" Electric bench grinder	كوسرة منضدية كهربائية قياس 10 انج	1
Bolt cutter	قاطع مسامير	2
h.d. pipe cutter (wide roll)	قاطع أنابيب للاستعمال الثقيل	6
Bench vise	منكنة منضدية	6
24' Extension ladder	سلم متحرك 24 فوت	1
3/8" Variable speed, reversing battery drills with charger (cordless)	تقب ذو سرع مختلفة قياس 8/3 انج يعمل بالبطارية مع شاحنة	2
6' A-frame ladder	طول 6 فوت A سلم على شكل حرف	2

10' A-frame ladder	طول 10 فوت A سلم على شكل حرف	1
7' Sections baker scaffold	سقالة (سكلة) ذات مقاطع طول 7 فوت	4
Wet-dry vacuum	مجففة كهربائية	1
Adjustable pipe support/rollers	دعامة (ساندة) للأنابيب قابلة للتغيير	2
Ratchet pipe reamer	رايمر بوري يدوي ذو سقاطة	2
Sewer and drain cleaning machine - 3" and under	ماكينة شفت وتنظيف البالوعات قياس 3 أنج فما دون	1
Prest-o-lite with tips	عدة لحام كاملة مع الملحقات نوع (prest-o-lite)	6
Oxy/act torch outfit (complete with cart)	مشعل لشعلة أوكسي أستيلينية (عدة كاملة مع الملحقات)	2
Soil pipe assembly tool	عدة تركيب أنابيب المجاري	1
Builder's level and stick	شاقول بناء	1
Portable electric h.d. saber saw	منشار محمول للاستعمال الثقيل على شكل سيف	1
Acetylene tank	خزان أستلين	2
Oxygen tank	خزان أوكسجين	2
Test pump and gauge/hydrostatic pump	مضخة فحص مع عدادات فحص الضغط	1
Portable electric band saw	منشار حزمي كهربائي متحرك	1
* Work bench or table	منضدة عمل	6
Rotary parts storage bin	حاوية أوساخ	2
Pipe storage rack	رفوف لخزن الأنابيب	2
Manometer or mercury gauge	مقياس ضغط أو مانومتر	1