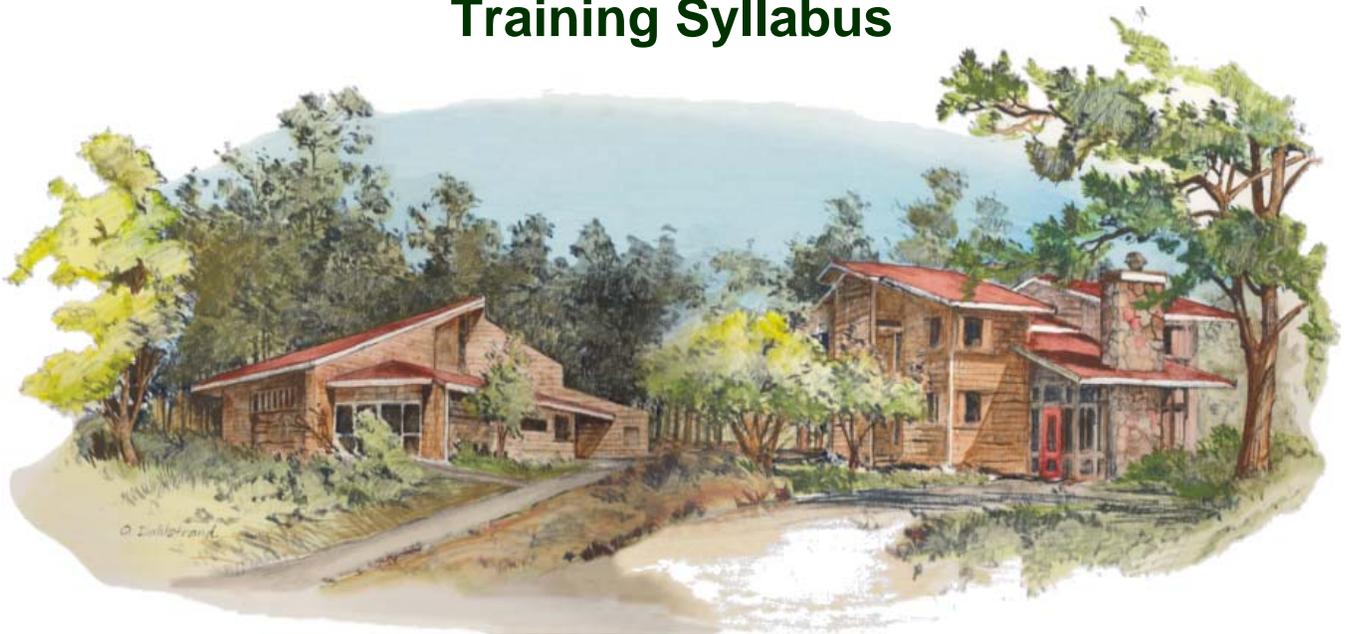


BASIC PLUMBING SKILLS

November 25-30, 2012

Training Syllabus



William Penn Mott Jr. Training Center



Memorandum

Date: November 19, 2012

To: Supervisor

From: **William Penn Mott Jr. Training Center**
Department of Parks and Recreation

Subject: Employee Attendance at Formal Training
Basic Plumbing Skills Group 21

An employee from your office will soon be attending the formal training program described in the attached. Please insure that the employee is fully prepared to attend the session and that the groundwork is laid for the employee's implementation of the training upon returning to work.

You can assist with capturing the full value of the training by taking the following steps:

Prior to Training

1. Make sure that **specific** employee needs are identified and, if necessary, called immediately to the attention of the Training Coordinator.
2. Review with the employee the reason for the employee's attendance.
3. Review objectives and agenda with the employee.
4. Discuss objectives and performance expected after the training.

Immediately Following Attendance

1. Discuss what was learned and intended uses of the training.
2. Review the employee's assessment of the training program for its impact at the workplace and review the due date of the Post-Training Evaluation form.
3. Support the employee's use of the training at the work place.

Prior to Three Months Following Training

1. Employee after discussion with the supervisor login to the Employee Training Management System (ETMS) to complete the Post-Training Evaluation form.
2. Supervisor evaluates the effectiveness of the training on the employee's job performance and login to the ETMS to complete the Training Effectiveness Assessment form.

Thank you for your assistance in seeing that the full benefit of training is realized.



Joanne Danielson
Acting Department Training Officer

Attachment

cc: Participant

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***Mission Statement
Training Section***

***The mission of the Training Section is to improve
organizational and individual performance through
consulting, collaboration, training and development.***

TRAINING SECTION STAFF

Joanne Danielson Acting Department Training Officer

Juventino Ortiz..... Acting Academy Coordinator

Pat Bost Office Manager

Chuck Combs Training Specialist

Sara M. Skinner Training Specialist

Dave Galanti Training Specialist

Karyn Lombard Training Specialist

Matt Cardinet Cadet Training Officer

Dan Kraft..... Cadet Training Officer

Nicole Shannon Cadet Training Officer

Dan Raducanu..... Cadet Training Officer

Pamela Yaeger Assistant Program Coordinator

Edith Alhambra Assistant Program Coordinator

Ellen Dewsnap..... Assistant Program Coordinator

Socorro Wallace Program Assistant

Joanne Ciccone Program Assistant

Ginger Henry Program Assistant

Rogers Williams..... Program Assistant

THE MISSION

of the California Department of Parks and Recreation is to provide for the health, inspiration and education of the people of California by helping to preserve the state's extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high quality outdoor recreation.



FORMAL TRAINING GUIDELINES

Welcome to formal training, an essential component in your career development.

Since 1969, our Department has been providing a continuously changing number of diverse training programs at its main training facility, the William Penn Mott Jr. Training Center and other locations including Marconi Conference Center. The Department strives to enhance your learning and job performance with formal training of the highest quality.

Our Department's dedication to training is only one aspect of its commitment to you and to the public. This commitment is costly and represents an important investment in you and your career. You and the Department realize a return on that investment by your positive participation in formal training itself and post training follow-through.

The program you will be participating in is described in this training syllabus, which outlines what you can expect from this training and what is expected of you. This syllabus details what you should do before you leave for training; what to do when you arrive; what you will be doing while in training; and, importantly, what you should be able to do when you return to your work site. Specifically:

1. **SYLLABUS:** The syllabus is now accessible on the Employee Training Management System (ETMS). You should print a copy of the syllabus to bring with you to class. Your copy of this syllabus is an important part of your training experience and should be brought with you to training. Read it before you arrive and review it following the program along with material you received at training.
2. **PRE-TRAINING ASSIGNMENTS:** Your completion of pre-training assignments is essential to the success of your training. You are responsible for all reading assignments in preparation for classroom sessions. Time will be provided during working hours to accomplish any assignments which involve either individual or group efforts and resources. (Pre-training assignments are listed in the "Training Attendance Requirements" section.)

3. TRAVEL: Arrange your travel to and from the training through your District or Office. (No reimbursement for travel expense - including per diem costs - will be approved for travel not specifically authorized in advance by the District Superintendent.) Individuals may claim reimbursement for incidental expenses incurred as outlined in DAM 0410.6. The Mott Training Center does not have the capability to provide transportation to/from Monterey Airport.

The cost of your travel (air fair, mileage, rental car, etc.) is paid by your District or Office **to** and **from** the location of the training.

4. HOUSING: Housing will be assigned to you on a shared-room basis and will be available from 3:00 p.m. on the date of arrival to 12:00 noon on the date of departure. The Department provides your room and board expenses at the Mott Training Center only. No per diem allowance will be authorized for living off-grounds. This does not preclude living off-grounds at your own expense. Please advise the Department Training Officer no later than one week before your scheduled arrival if you plan to live off-grounds. No animals are permitted in Asilomar housing. In the event of an emergency, staff must know your room assignment, therefore, you may not switch rooms without staff approval. Overnight guests are not allowed in the buildings unless registered beforehand at the front desk in Asilomar's Administration Building. Quiet hour for lodge living areas is 10:00 p.m.

Please Note: You may be assigned a room at a motel while attending training. If so you may be asked to present a valid credit or debit card while checking in to your room. Many motels require a credit card to cover charges incurred such as telephone calls, damages to rooms and/or furnishings, fees to clean rooms that have been smoked in that are not designated as smoking rooms, etc. Please be prepared to handle this appropriately.

5. **ENROLLMENT OR HOUSING CANCELLATION POLICY:** To cancel participation in a course, the participant must have their District Superintendent or Section/Office Manager send an email to the Training Specialist assigned to the course requesting to remove the participant. If you do not need lodging or must change or cancel your reservation for lodging, you must contact the Mott Training Center or Training Specialist assigned to the course at least 72 hours prior to your date of arrival. Lodging, registration, and associated fees will be charged to the employee's District or Section/Office if a training cancellation is received with less than 72 hours notice.

The Mott Training Center is committed to ensuring that the reservation that has been made for you is accurate and needed.

6. OFF-GROUNDS ACCOMMODATIONS: When authorized to stay off-grounds by the Department Training Officer, the Mott Training Center will pickup the cost of your room and meals at the current DPR Asilomar rate. If you stay off grounds and have meals on grounds, the Mott Training Center will authorize only what the Department pays Asilomar for lodging.
7. MEALS: Meals will be provided, semi-cafeteria style, from dinner on the date of arrival through lunch on the date of departure. Meals will be served at 7:15 a.m. for breakfast, 12:00 noon for lunch, and 6:00 p.m. for dinner. Hot or box lunches may be provided on some days. If you require a special diet, notify the Asilomar Chef at 831-372-8016 no later than one week before your scheduled arrival.

In order to assist participants with limited mobility, Asilomar provides a shuttle to and from the dining hall. Please contact either Asilomar staff upon check in, or Mott Training Center staff upon your arrival, for instructions on arranging a transport.

8. CLOTHING: Field uniforms as found in "Description of Required Field Uniforms", DOM Chapter 2300, Uniform Handbooks, not including optional items, will be worn daily by all uniformed employees during formal training sessions **unless otherwise specified in the Program Attendance Checklist**. Non-uniformed employees shall wear apparel normally worn on the job. Appropriate attire includes apparel suitable for professional office dress. It does not include such items as shorts, t-shirts, tank tops, or sandals.

Because we are on the conference grounds with many other groups, and the image we project as State Park employees is important not only during working hours but off duty hours as well, your informal sportswear should be appropriate.

9. ROOM SAFES: Two safes have been installed in each of the lodge rooms used by the Mott Training Center (Live Oak, Tree Tops, and Deer Lodge). These safes are a type that allows the user to input their own combination of numbers to facilitate opening and closing. The Mott Training Center has a master key for emergency entry. Safes are to be left in the open position when checking out of your room.
10. WEAPONS: Weapons are permitted in rooms under the following conditions. Authorized firearms and magazines stored while at the Mott Training Center shall be in a safe condition and stored in one of the following locations: your room safe in Live Oak, Tree Tops, or Deer Lodge, one of the Mott Training Center's safes in the Whitehead Room or secured in your vehicle.
11. ALCOHOLIC BEVERAGES: Participants shall not possess or consume alcoholic beverages in common areas (living room) while on the Asilomar Conference Grounds unless provided and hosted by Concessionaire ARAMARK.

12. **SMOKING:** Smoking is not permitted in the Mott Training Center or in any lodge or guest room on the Asilomar Conference Grounds.
13. **TRAINING CENTER:** The Mott Training Center is located on Asilomar Conference Grounds, part of Asilomar State Beach. The Conference Grounds are operated for our Department by a concessionaire, and all lodging and food services are provided to us by employees of the concessionaire. Constant efforts are made to maintain a sound, harmonious working relationship between the Department and concessionaire. None of us can expect preferential treatment for any reason and, as a departmental employee, you will be expected to join in our continuing effort toward an effective relationship with each Asilomar concession staff member. On occasion, non-departmental groups may be staying in the same lodges. It is imperative that you represent the Department well on and off duty.
14. **REGISTRATION:** When you arrive at Asilomar Conference Grounds, go directly to the front desk at the Asilomar Administration Building for your room key and dining room ticket. If you require vegetarian meals, notify the front desk representative and your meal ticket will be marked accordingly.
15. **COURSE LEADERS:** The formal training you will attend is developed and, for the most part, conducted by experienced State Park employees in field and staff positions. Some courses will be conducted by qualified instructors from other agencies and educational institutions. Your course leaders have proven their ability and knowledge in their profession, and provide a level of expertise difficult to match.
16. **TRAINING SECTION STAFF:** Chuck Combs is your Training Specialist and has been assigned the responsibility for your training group. That staff member usually serves as a Course Leader as well as a Coordinator. During the program, you may be asked to assist Training Section Staff in the logistics of your training program (organizing field trip transportation, supervising classroom breaks, etc.). Training Section Staff will do all within their power to make your training experience pleasant and meaningful.
17. **TRAINING MATERIALS:** May be made available to you at both your unit and the Mott Training Center. Handout materials issued at your unit should be brought to training for possible use. A conference binder or notebook will be issued to you at the training session for note taking and convenience in handling materials. Copies of DAM and DOM will be available to you for self-study. Bring your own pens and pencils.
18. **ATTENDANCE:** Regular attendance is a critical course requirement and your participation is important to the success of this training. An absence of more than 10% of the course hours constitutes grounds for dropping a participant from the course. The Department Training Officer may modify this requirement based upon participant knowledge level and/or the portion of the course missed. All absences,

except those of an emergency nature, must be approved in advance by the Training Specialist.

19. **COLLEGE CREDIT:** Most training programs are accredited by Monterey Peninsula College for lower division credit. If you successfully complete an accredited program, you will receive either a letter grade or a credit/no-credit designation.
20. **MPC STUDENT ID:** If you have filled out an MPC application before, you have already been issued a Student ID number to use in lieu of your SSN on future applications. You can obtain your MPC Student ID number by going to their secure website and providing your SSN number (no name required) and birthdate.
 - To obtain the number, logon at: <http://www.mpc.edu>
 - In the column on the left side of the screen, click on Registration (WebReg).
 - In the form that comes up and is titled: Have you applied for a BOG Fee Waiver, enter your Social Security Number in the box that is titled MPC/ID, and enter your birthdate in the second box.
 - Click on Login
 - The system will then come back with your MPC Student Identifier (SID).

You can store your MPC ID number in your ETMS Profile for future reference.

Newcomers to training will need to provide their SSN on the first MPC application only, after which a student ID number will be assigned and available by following the instructions above within a few weeks of the program's conclusion.

21. **VEHICLES:** All vehicles should be parked in the lots adjacent to the Mott Training Center. Any questions regarding use of a State vehicle while at the Mott Training Center should be discussed with your supervisor prior to your departure for training, or with your Program Coordinator while at the Mott Training Center.
22. **BICYCLES:** If you bring your bicycle, store it in the bicycle shed next to the Mott Training Center. Bicycles may not be brought into any building nor chained to lamp posts, trees, etc. The Mott Training Center has a limited number of bicycles available for your use. Prior to your use, you are required to complete a safety inspection and sign a waiver which is posted in the bicycle shed.
23. **MAIL:** Mail forwarded to you during your time at the Center should be addressed to you in care of:

Department of Parks and Recreation
WILLIAM PENN MOTT JR. TRAINING CENTER
P. O. Box 699, Pacific Grove, CA 93950

24. CELL PHONES: As a courtesy to your fellow participants and course leaders ensure that your cell phone is turned off during classes. Participants should not be receiving or making cell phone calls during class time. Please limit those calls to your breaks.
25. FAX: The Mott Training Center's FAX number is (831) 649-2824.
26. TELEPHONE: Limit phone calls during classroom hours to urgent business or emergencies. Anyone wishing to contact you by telephone during working hours should call the Center at (831) 649-2954. Calls after 5:00 p.m. or during weekends should be made to (831) 372-8016, Asilomar Conference Grounds, and the caller should tell the switchboard operator you are with a California State Parks training group. **Please Note: There are no longer pay telephones outside of the Mott Training Center. There are pay telephones located at the Asilomar Administration Building.**
27. LAUNDRY AND DRY CLEANING: May be taken care of by you at one of several local establishments.
28. RECREATION: Facilities available on grounds include a heated swimming pool, ping-pong and pool tables, and a volleyball court. The Monterey area offers horseback riding, golf, tennis, racquetball, deep sea fishing, and many historical landmarks and scenic sights to explore.
29. POST-TRAINING ASSIGNMENTS: In connection with formal training are to be completed under the direction of your supervisor. See "Program Attendance Requirements" in this syllabus.
30. COFFEE BREAK REFRESHMENTS: Will be available throughout each session. You will be asked to contribute to the "Hospitality Fund" to defray expenses. Please bring your own coffee cup.

PROGRAM ATTENDANCE CHECKLIST

To assist you in your preparation for formal training session at the William Penn Mott Jr. Training Center the following list is provided:

- _____ 1. Read and understand the Basic Plumbing Skills Program Syllabus prior to your arrival at the Training Center.
- _____ 2. Complete the following prior to reporting to training.
- Review and complete the Basic Plumbing Skills Study Guide included with your syllabus and bring it with you to training. It will be collected during the program orientation.
 - Discuss the Basic Plumbing Skills program with your supervisor. What specific changes in your abilities and performance are expected to result from you attending this training? List these expectations along with your own under "Expectations" on the back of the "Equipment Checklist".
 - Discuss the projects you will be assigned in the next twelve months, which will utilize the skills developed during the training program.
 - Make arrangements with your supervisor to demonstrate your ability to safely use the items listed on the Equipment Checklist. All items must be initialed by your supervisor or your supervisor's representative and signed by your District Maintenance Chief for you to participate in the practical portion of the training program.

NOTE: The pre-training assignment (Basic Plumbing Skills Study Guide, Equipment Checklist and Expectations) will be collected during the program orientation. Bringing the required safety equipment and completion of the pre-training assignment are mandatory. They will count for 20% of your program grade. If you have questions or need help, call Program Coordinator Chuck Combs at 831-649-7124 or e-mail at chuck@parks.ca.gov.

- _____ 3. Arrange your travel through your District Office.
- _____ 4. Remember to bring the following with you to training:
- Program Syllabus, study guide, and all pre-training assignments.
 - Personal Safety Equipment (eye, ear, head, and hand protection).
 - Coveralls or appropriate work clothing.
 - Foul weather gear due to the possibility of rain during the program. It is required that you bring rain gear with you.
 - Proper field uniform, see Formal Training Guidelines #8.
 - Coffee cup, reusable water bottle, alarm clock, pens and pencils.

POST-TRAINING ASSIGNMENT

Prior to ninety days after the completion of this program, the employee and his/her supervisor should sit down and discuss the impact and assess the effectiveness this program has had on the employee. Then both the supervisor and employee should login to the Employee Training Management System (ETMS) and complete the Post-Training Evaluation form (an email will be sent to both employee and supervisor notifying them that the evaluation needs to be completed).

The post-training evaluation process is intended to provide a bridge between classroom instruction and the on-the-job application of training. The information obtained through this process will assist the training participant, supervisor, and Training Center in providing a return on the investment the Department has on training.

BASIC PLUMBING SKILLS GROUP 21 – A G E N D A – November 25-30, 2012

Lead Instructor: John Mackey
Assistant Program Coordinators: Dana Sarandria, Craig Yamashita, Mark Casanova, and Margaret Hurley

Special Notice:

This program will be conducted at the Mott Training Center Shop Annex, 2211 Garden Road, Building C, Monterey, California. Vans are available to transport you to and from the Shop Annex and will leave the Mott Training Center promptly at 0800 daily and return by 1700.

Sunday

November 25

1500- REGISTRATION: *Check in at Asilomar* All
Conference Grounds Administration Building

Monday

November 26

0830-0930 Orientation/MPC Registration/Expectations Combs
0930-1000 Review Pre-Training Assignment Mackey
1000-1200 Task Hazard Analysis/Plumbing Safety Mackey/Combs
1200-1300 Lunch
1300-1315 Name That Part Mackey
1315-1430 Tools of the Trade Mackey
1430-1630 Introduction to Plumbing Systems/Materials Mackey

Tuesday

November 27

0830-0900 Name That Part Mackey
0900-1000 Introduction to Pipefitting Mackey
1000-1200 Shop Applications All
1200-1300 Lunch
1300-1630 Shop Applications All

Wednesday

November 28

0830-0900 Name That Part Mackey
0900-1030 Introduction to Pipefitting (continued) Mackey
1030-1200 Pipe Repairs (demonstrations) Mackey
1200-1300 Lunch
1300-1600 Shop Applications All
1600-1630 Study Guide (home work) All

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Thursday

November 29

0830-0900	Name That Part	Mackey
0900-1000	Review Study Guide	Mackey
1000-1200	Introduction to Pipefitting (continued)	Mackey
1200-1300	Lunch	
1300-1630	Shop Applications	All

Friday

November 30

0830-0900	Name That Part	Mackey
0900-0930	Exam Review	Mackey
0930-1030	Final Exam	Mackey
1030-1100	Review Exam	Mackey
1100-1130	Count the Parts	All
1130-1230	Program Summary, Expectations, and Evaluation	Combs
1230-	Lunch and Depart	

TRAINING PROGRAM: BASIC PLUMBING SKILLS

36 HOURS

PROGRAM OUTLINE

Total
Hours

ORIENTATION..... 1.0
Program Overview.....

PLUMBING SYSTEMS 5.5
Purpose.....
Materials.....
Tools
Fixtures

PIPEFITTING 10.5
Drain-Waste-Vent.....
PVC Water Distribution
Iron Pipe.....
Copper Pipe
DWV and Water Distribution Applications

PLUMBING REPAIRS..... 6.0
Plumbing Fixture and Appliance Repair
Water Distribution Repairs

EXAMINATIONS AND LABS 12.0

PROGRAM EVALUATION 1.0

Total Hours 36.0

BASIC PLUMBING SKILLS

PROGRAM ORIENTATION

Purpose: Participants will meet one another and the program coordinator and facilitator. The group will share expectations for the training program. In addition, program content will be reviewed.

Performance Objectives: By the close of the session the participant will

1. Review program content, procedure, and evaluation processes.
2. Share and record expectations with group members.
3. Adhere to all Training Center guidelines.

INTRODUCTION TO PLUMBING SYSTEMS

Purpose: To familiarize park maintenance workers with plumbing systems, materials and tools which will enable them to make routine plumbing repairs.

Performance Objectives: By the close of the session the participant will

1. Review the basic components of plumbing systems used in the general plumbing trades.
2. Discuss the materials used in plumbing systems within California State Parks.
3. Identify the correct tools to use when making repairs to plumbing components and systems.

INTRODUCTION TO PIPEFITTING

Purpose: To familiarize park maintenance workers with the methods of cutting, joining, and repairing plumbing systems found in California State Parks.

Performance Objectives: By the close of the session the participant will

1. Identify the common plumbing tools and materials currently used in the plumbing trades.
2. Demonstrate correct cutting and joining procedures for PVC plastic pipe.

3. Demonstrate correct cutting and joining procedures for ABS plastic pipe, copper pipe, and steel/iron pipe.

PLUMBING FIXTURES AND APPLIANCES

Purpose: To familiarize park maintenance workers with a variety of plumbing fixtures, valves, and fixture drains.

Performance Objectives: By the close of the session the participant will

1. Discuss the more common plumbing fixtures and appliances used in California State Parks and general plumbing trades.
2. Review the proper use and function of various plumbing fixtures.
3. Identify the knowledge and skills necessary to diagnose plumbing fixture problems and to make subsequent fixture repairs.

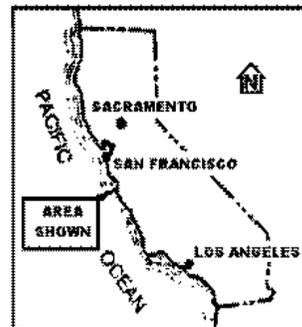
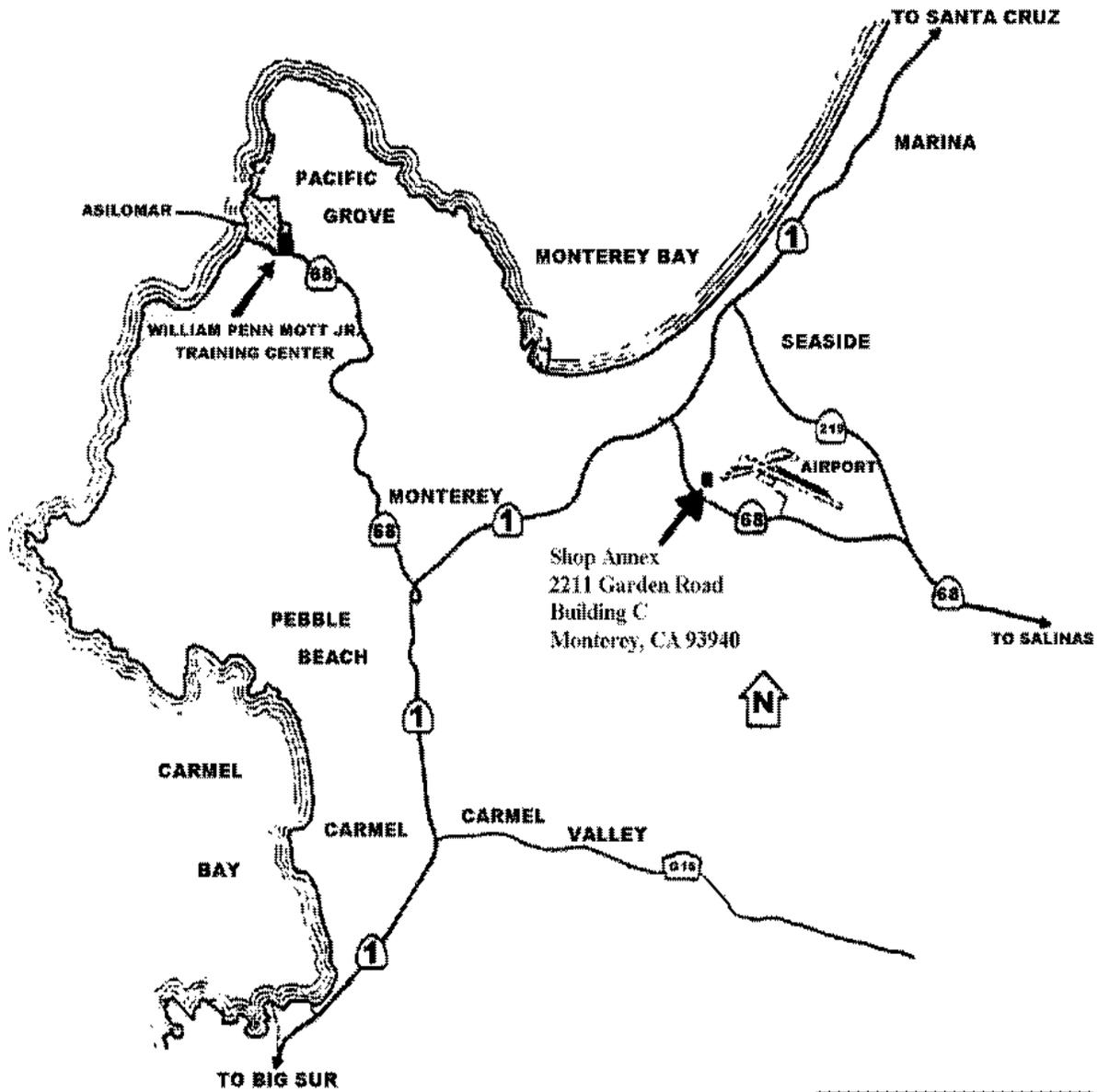
SHOP APPLICATIONS

Purpose: To provide the participant with hands-on instruction and opportunity to practice acquired plumbing knowledge and skills.

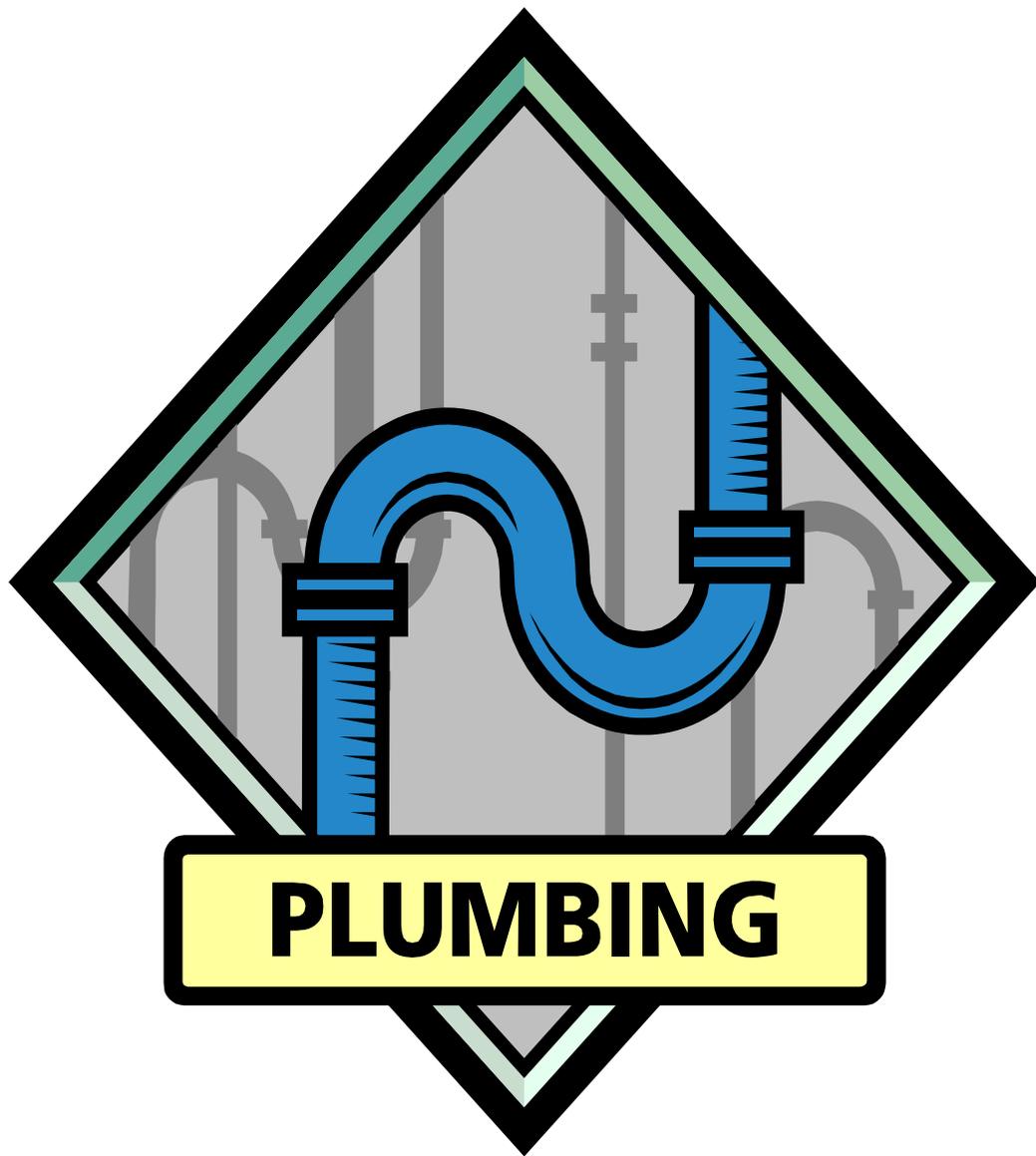
Performance Objectives: By the close of the session the participant will

1. Apply classroom knowledge and information to an actual building plumbing repair effort.
2. Demonstrate the ability to assemble plumbing components and make repairs.
3. Demonstrate the ability to work effectively, safely, and harmoniously with other class participants in a simulated work environment.

location map for
WILLIAM PENN MOTT JR. TRAINING CENTER
837 ASILOMAR BLVD.
PACIFIC GROVE, CALIFORNIA 93950



Basic Plumbing Skills Workbook



INTRODUCTION TO PLUMBING CODES

All work performed on facilities within the California State Park System must comply with State law. Requirements for providing clean water and toilet facilities are defined in the California Health and Safety Code, California Plumbing Code (Title 24), and California Occupational Safety and Health Regulations (Title 8).

The primary law pertaining to plumbing performed by Park Maintenance Worker is the California Plumbing Code (CPC). The California Plumbing Code consists of state standards and sections from the latest edition of the Uniform Plumbing Code (UPC). The CPC must comply with the UPC. The CPC can be more strict than the UPC but, it cannot be less strict. The purpose of the CPC is to provide minimum standards to safeguard the public's welfare against hazards that may arise from the use of plumbing systems in state owned facilities.

The provisions of the CPC apply to construction, alteration, demolition, and repair of all plumbing, gas, or drainage piping and systems, and water heating or treating equipment, in or on any state owned building, structure, or outdoors.

1. The California Plumbing Code states that additions and repairs to state owned buildings must comply with the _____.
2. The Code applies to all plumbing, gas, or _____ piping.
3. The Code also applies to water heating and water _____ equipment.

INTRODUCTION TO PLUMBING SYSTEMS

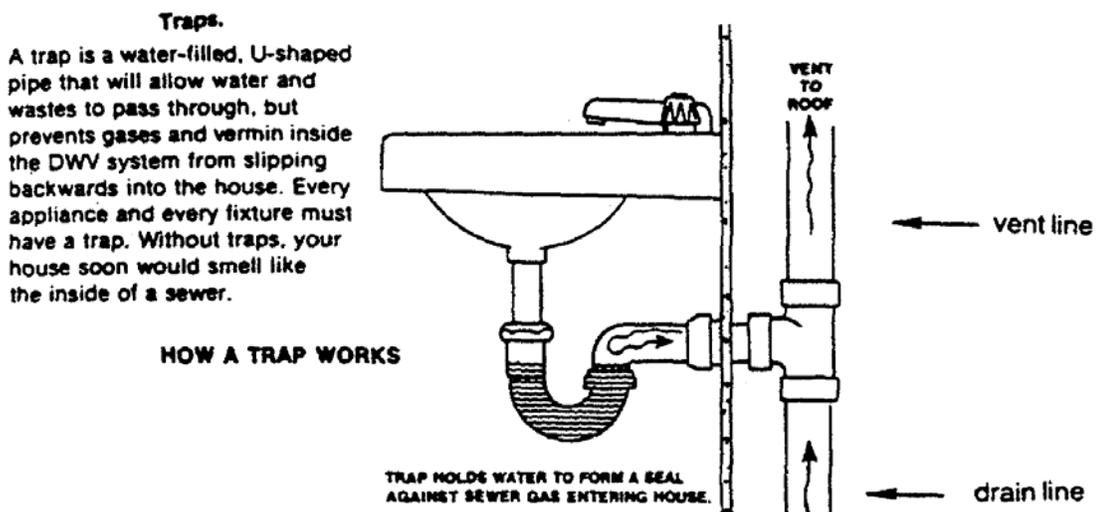
The definition of a "System" is "A group of elements that interact and function together as a whole." Plumbing systems found in state owned buildings include water supply systems, drain-waste-vent systems, fuel supply systems, appliance vent (flue) systems, steam systems, and pneumatic (air) systems. This training program will focus on the water supply systems, drain-waste-vent systems, and fuel supply systems typically found in state park residences and public buildings.

Fresh water is carried under pressure from the well or water meter (service entrance) through the building water supply system to each fixture and appliance. The main water shutoff valve is usually located at the water meter or where the supply line enters the building. Water supply pipes in park houses and offices are generally small, with inside diameters from 3/8 to 1 inch. Supply pipes in public restrooms are generally 1 to 2 inches in diameter. Once inside the building, the water supply pipe is divided at the hot-water heater into hot- and cold-water systems. Pipes for the two systems usually run parallel to each other throughout the building. Some of the cold water-supply pipes end in outdoor faucets (hose bibbs) for garden hoses and irrigation systems.

Although called "systems", the cold water system, the hot water system, the solar water heating system, and the irrigation system, are not truly different systems, but are components of one system - the water supply system.

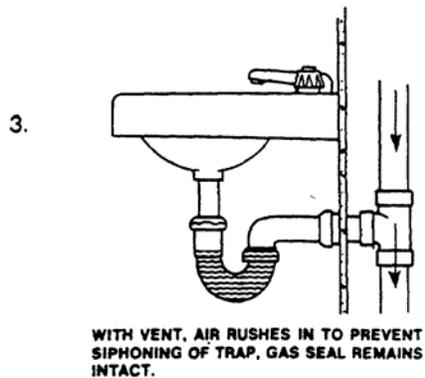
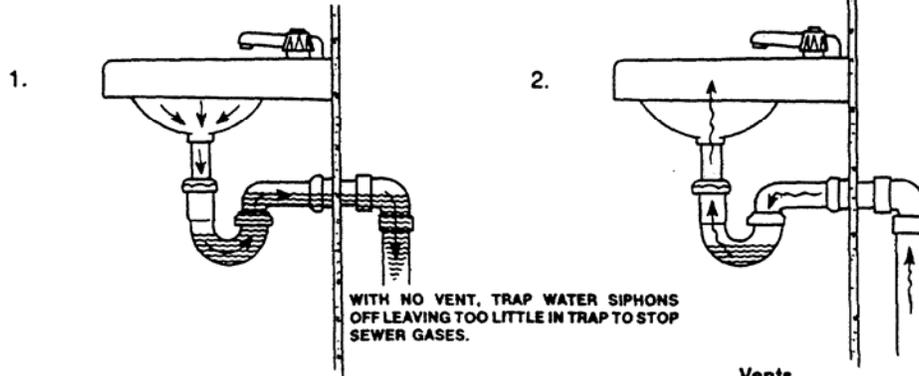
The drainage system is completely isolated from the water supply system. Drain-pipes are generally larger than incoming water-supply pipes, varying from 1-1/2 to 4 inches in inside diameter. The drainage system handles drain water removal, waste removal, and venting. The "Vent" portion of the DWV system extends from the level of the trap arm through the roof. The "Drain" or "Waste" line begins at the fixture and eventually connects to the sewer system. Waste pipes carry wastes by gravity away from each fixture into larger drainpipes which carry the flow downward into the house sewer line. Drainpipes are sloped 1/4 inch fall per foot of run and vent pipes are 1/4 inch rise per foot run. At each fixture the drain passages contain a P- shaped bend called a trap. Because of its shape, the P-trap is usually the first to clog. The trap retains water that acts as a seal to prevent gases, bacteria, and vermin from entering the house. Vent pipes carry off sewer gases and keep the whole DWV system at atmospheric pressure, necessary to maintain the water seal in each trap. Without venting, pressure from collected gases in any portion of the DWV system could force and break the trap's water seal. If atmospheric pressure were not maintained, trap water would siphon away.

As you study the plumbing systems, be sure to notice that the different systems are never connected, or cross-connected, to any other system. Because the DWV and water supply systems are both opened at the fixture, this is a likely spot for a "cross-connection" to occur. The best method for preventing back-siphoning due to cross connections is to maintain an air separation between the water supply and DWV systems. Maintenance workers must always be alert for any condition which might allow pollutants to back-siphon into the water supply system from fixtures (toilets, lavatories, bathtubs, showers, sinks, and laundry tubs) and appliances (clothes washers, dishwashers, and garbage disposal).



Main vents serving toilets, and secondary vents serving other fixtures, extend through the roof where they are open to the air. Some systems have revents that connect their fixtures to a main or secondary vent instead of going directly through the roof. DWV pipes that carry toilet waste are called soil pipes and must be at least 3 inches in diameter. A large vertical drain-waste line in a building is called the soil stack. The soil stack serves as a vent and a drain. Every DWV system contains plugged openings called cleanouts to provide access to the inside of the DWV system for removal of blockages. To remove blockages, use a plunger, snake, auger, hose (beware of cross-connection) or other mechanical means. Chemical drain cleaners **should not** be used unless all other mechanical means have failed.

HOW A VENT WORKS



Vents.

water rushing along by gravity through a pipe creates a suction or vacuum at the high end of the pipe above it. This is called siphon action. Siphon action is powerful enough to suck all the water out of a trap and leave it nearly dry, as happens in a toilet bowl after a flush. But, since other fixtures and appliances aren't designed to replace siphoned-off trap water as a toilet is, some means of preventing trap siphoning must be built into the DWV system. This is accomplished by venting the system to outside air. Venting inside the house would work too, but then sewer gases would escape into the house. Thus, venting is done outside above the roof.

4. The _____ system carries water from the water main, or well, into the building and around to all the fixtures and appliances.
5. The _____ portion of the DWV system carries used water and waste out of the building.
6. The _____ portion of the DWV system carries sewer gases out of the building and maintains _____ in the drain pipes.
7. The main water shutoff valve, which turns the water for the entire building on and off is usually located at the _____ or where the supply line _____ the _____.
8. Once inside the building, the water supply line is divided at the water heater and becomes the _____ and _____ water supply systems.
9. The hot water supply line is typically installed _____ to the cold water supply line.
10. The water supply line brings water into the building under pressure, the drain-waste lines carry waste water away by _____.
11. The normal pitch for drain-waste lines is _____ inch of fall per foot of run.
12. The cold water system, hot water system, solar water heating system, and irrigation system components of the _____ system.
13. The _____ allows water and waste to pass but prevents gases and vermin from entering the house through the DWV system.
14. _____ are installed in the DWV system to prevent fixture traps from siphoning.

INTRODUCTION TO PLUMBING AND PIPEFITTING

WATER SUPPLY

The California Plumbing Code (CPC) states: "Except where not deemed necessary for safety or sanitation by the Administrative Authority, each plumbing fixture shall be provided with an adequate supply of hot and /or cold potable running water piped thereto in an approved manner...".

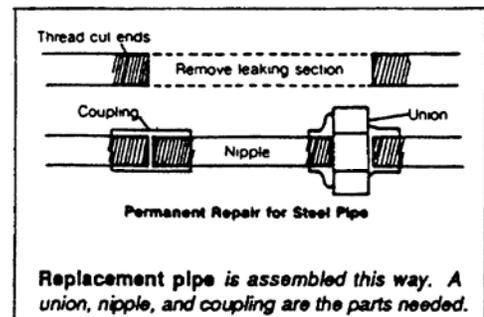
Water pipe and fittings may be made of brass, copper, cast iron, galvanized malleable iron, galvanized wrought iron, galvanized steel, polyethylene (PE), and Polyvinyl Chloride (PVC). The most commonly used materials in State Park water supply systems are brass & copper, galvanized steel, and Polyvinyl Chloride (PVC).

Steel (Galvanized) Pipe

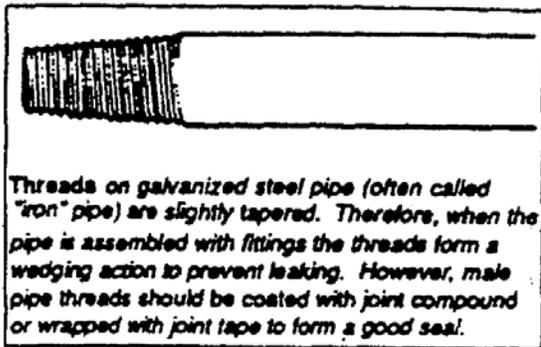
Steel (galvanized) pipe has been used in more park facilities than any other plumbing material. Steel pipe was commonly used for water supply systems in residences built before 1970, and is still used in outdoor areas where a tough material is needed to withstand physical impact or earth movement.

Corrosion on the outside of galvanized steel pipe can be reduced by minimizing the number of places the pipe is held with the vise or wrenches. Where the zinc coating has been damaged, the life of the pipe may be prolonged by treating the damaged areas with cold zinc compound, wrapping tape, or asphaltic emulsion.

Two problems with steel pipe are corrosion and mineral build-up. When working with galvanized steel pipe, the pipe wrenches and threads damage the pipes protective zinc coating. When the zinc is removed, the pipe will rust and eventually leak. Inside the pipe, rust begins to form as the water and chemicals dissolve the protective interior zinc coating. Blister like "tubercles" form on the pipe walls, restricting and eventually choking off the flow of water. Mineral deposits will also collect inside steel pipe to further reduce the flow of water. When this happens, replacing the pipe is the only remedy. To replace a leaky section, cutout section with hacksaw or reciprocating saw. Thread ends using generous cutting oil and stop threading when one thread extends past the cutter. Use a nipple, coupling and union, as shown at right to complete repair. The parts inside the union are not coated with compound.



Iron pipe fittings have either "male" or "female" threads. The threaded end of a galvanized pipe or nipple can be described as having "male iron pipe threads" (abbreviated mipt or mpt). A "coupler" or "elbow" ("ell") can be described as having "female iron pipe threads" (abbreviated fipt or fpt).



Pipe threads are tapered. The taper creates a wedging action that produces tremendous pressure as the threads are turned into a fitting. Pressure alone is not enough to prevent a joint from leaking. Before assembling the pipe, the male threads must be sealed with pipe joint compound or Teflon joint tape. The joint compound/tape works with the tapered pipe threads to prevent leaks. The tape must be wound in the direction the threads turn into the pipe fitting. Brass valves and fittings are easily damaged. Avoid over tightening.

15. Pipe wrenches and threaders damage galvanized pipes protective _____ coating.
16. To remove a section of galvanized pipe where no union has been installed, the pipe must be cut with a _____ or reciprocating saw.
17. When threading galvanized pipe use generous amounts of _____ oil.
18. When threading galvanized pipe, stop threading when the pipe extends about _____ beyond the cutter.
19. Pipe threads will leak if not properly sealed. To seal pipe threads apply joint (TEFLON) tape or pipe joint compound to the _____ threads only.
20. TEFLON joint tape must be wound around the _____ threads in the direction the threads turn into the pipe fitting.
21. The repair parts needed to replace a section of pipe are a _____, a _____, and a _____.
22. The pipe ends inserted into a union fitting should be coated with thread compound or tape. The parts inside the union _____ coated.

Copper Pipe

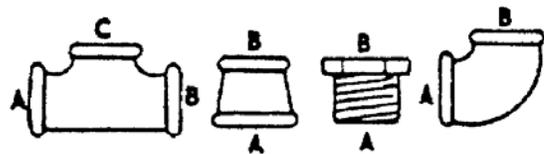
Copper pipe (Rigid or Flexible) is superior to galvanized pipe in almost every application. Rigid copper pipe is sold in 10 or 20 foot lengths. Flexible is sold in 60 foot coils. It is lighter, easier and faster to install or repair, does not corrode quickly, does not accumulate heavy mineral and scale deposits, and is resistant to damage. Copper has entirely replaced galvanized pipe as the material of choice for interior water supply lines. Use of copper pipe in underground exterior applications is limited by the cost of the material. The current cost of materials to run one hundred feet of one inch underground (type K) copper line with two tees is currently \$223.47. The material cost for galvanized iron is \$122.96, and for schedule 80 PVC, it's only \$45.77.

Fittings used with copper pipe are generally wrought copper or cast brass and may be threaded or have a smooth interior.

Threaded fittings must be sealed in the same way as for galvanized pipe.

Smooth "cup" fittings are sweat soldered. A "tee" which has a cup on both ends and is threaded on the side would be identified as CxCxT, or cup (one end) by cup (other end) by thread (side). Although the terms for identifying fittings vary, the order in which the openings are identified is not. Fittings are always identified by (1) large end, then (2) small end, then (3) large side, and then (4) small side.

HOW TO ORDER FITTINGS



When ordering a fitting, specify size pipe it is to fit. If different pipe sizes are involved, specify sizes in "A-B-C" sequence per illus. above.

Copper plumbing materials may be mixed with galvanized and/or PVC materials in the same system. Whenever copper pipe is joined to galvanized pipe the dissimilar metals generate an electrical current which is destructive to the iron pipe. To prevent this "electrolysis" from occurring, the copper and galvanized iron pipe must be insulated from each by installing a dielectric union.

23. There are two kinds of copper pipe available. They are _____ and _____.
24. Rigid copper pipe is sold in lengths of _____ or _____ feet.
25. Flexible copper pipe is sold in sixty-foot long _____.
26. Copper pipe (sometimes called copper tubing) is _____ to galvanized pipe in almost every application.

27. Copper has entirely replaced galvanized pipe as the material of choice for _____ water supply lines.
28. A wrought copper fitting having a "cup" end would be joined to the pipe by _____.
29. A wrought copper fitting identified as CxCxT, 3/4 x 3/4 x 1/2 would have a side opening that is _____ inch diameter.

Plastic Pipe

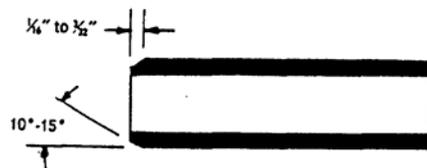
Plastic water pipe is lightweight, easy and fast to install or repair, does not corrode, does not accumulate mineral and scale deposits, and is very economical. Polyvinyl Chloride (PVC) plastic pipe is used extensively outdoors for water supply lines and irrigation systems. PVC water pipe is usually colored white (schedule 40) or gray (schedule 80). Yellow plastic pipe is CPVC, which is approved for both hot and cold water systems. Orange PVC plastic pipe is manufactured for use with gas and is never used in water systems. Rigid black plastic pipe is used only for DWV systems, and is never used for water supply.

PVC plastic pipe is not subject to deterioration from water or corrosion, but it is weakened and made brittle by ultraviolet light. It is very important to store PVC pipe out of direct sunlight. Because plastic does not resist mechanical damage as well as galvanized iron or copper pipe, it is not a good choice of material to use in exposed locations, in rocky soil, or in unstable geologic areas that are prone to movement.

Plastic pipe fittings are similar to copper fittings in that they may be either threaded or smooth. Smooth plastic fittings are referred to as "slip" fittings and are joined to plastic pipe by "solvent welding". Threaded fittings, available in male pipe thread and female pipe thread, are assembled in much the same way as threaded iron and copper pipe. Adapters are used to join plastic pipe with threaded material. Plastic pipe threads must be sealed, however, with pipe thread (TEFLON) tape. Because chemical solvents can weaken plastic pipe, pipe joint compound must never be used on plastic threads.

Experience has proven that poor solvent cementing causes 95% of all PVC failures and leaks. **DO NOT TAKE SHORT CUTS** or try to save on solvent cement! Make sure that pipe and fittings are of the same material. Do not mix PVC & CPVC components. Be sure to use the correct cement! GSR, a major manufacturer of PVC pipe, recommends the following steps for solvent welding schedule 80 PVC pipe and fittings.

- A. Cut pipe to the desired length. Pipe must be cut square. Use power cut off saw, plastic tubing cutter, or saw and miter box.
- B. Chamfer end of pipe:
- C. Use a clean rag to remove dirt, moisture, and



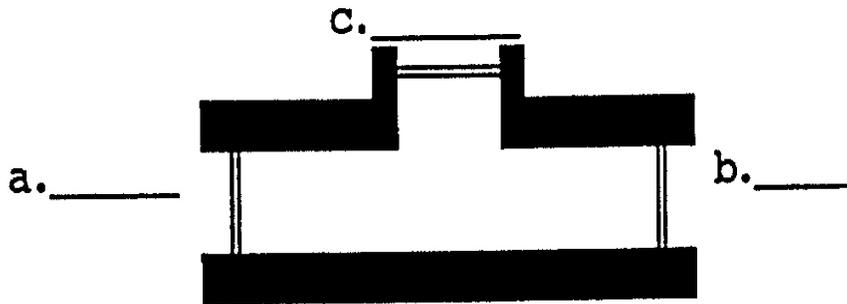
grease from the fitting.

- D. "Dry fit" pipe 1/3 to 3/4 depth of socket.
- E. Apply an even coat of primer to the pipe end and fitting socket until the surface begins to dissolve. Apply with brush or applicator.
- F. While the primer is still wet (for PVC) or tacky (for CPVC), apply an even coating of cement to the pipe end. Be sure there are no voids!
- G. While the primer is still wet (for PVC) or tacky (for CPVC), apply an even coating of cement to the fitting socket. Be sure there are no voids!
- H. Flow on a second full even coating to the pipe end. There must be more cement applied than appears necessary to fill the pipe joint. Use cement liberally!
- I. Quickly, while surfaces are soft and wet with solvent, force pipe into the fitting socket, giving the pipe a quarter turn. The pipe must be bottomed in the socket and held firmly for approximately 30 seconds. If not held, the pipe will try to push out.
- J. Wipe away excess cement. A properly made joint will normally show a bead of cement around the entire perimeter. Gaps may indicate a poor joint due to insufficient cement or the use of a light bodied cement.
- K. Do not disturb the joint until initial setup of the cement occurs. Recommended set time is related to air temperature as follows:

30 minutes	Minimum At	50 to 100 degrees F
2 Hours	Minimum At	40 to 60 degrees F
4 Hours	Minimum At	20 to 40 degrees F
6 Hours	Minimum At	0 to 20 degrees F

- 30. PVC stands for _____.
- 31. Plastic pipe is light weight, does not corrode and does not accumulate _____ and _____ deposits.
- 32. CPVC pipe can be used to transport _____ water.
- 33. PVC pipe should not be stored in direct sunlight because _____ can make it brittle.
- 34. PVC fittings are available in both "slip" and "threaded" varieties. The "slip" fittings are _____ to the pipe with solvent cement.
- 35. Male and female transition couplings called "adapters" are used to link plastic pipe to _____ material.

36. Air temperature is an important consideration when cementing PVC pipe. Colder air temperature requires waiting _____ to pressurize the line.
37. PVC threads should be sealed with _____.
38. A PVC fitting identified as SxTxS, 3/4 x 1/2 x 3/4, would be a tee with a threaded opening at letter _____, and sized as follows:

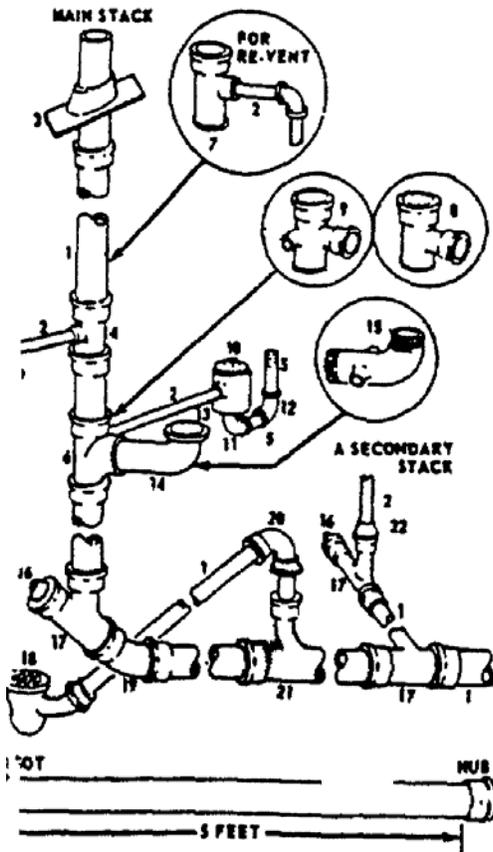


DRAIN WASTE AND VENT

The Uniform Plumbing Code (UPC) and California Plumbing Code (CPC) state that "It shall be unlawful for any person to cause, suffer, or permit the disposal of sewage, human excrement or other liquid wastes, in any place or manner, except through and by means of an approved plumbing and drainage system installed and maintained in accordance with the provisions of this Code." "All plumbing fixtures, drains, appurtenances and appliances, used to receive or discharge liquid wastes or sewage, shall be connected properly to the drainage system of the building or premises.....[and] every building in which plumbing fixtures are installed shall have a connection to a public or private sewer...".

At one time DWV systems were manufactured primarily from leaded cast iron and threaded steel pipe. These materials are still found in many state park facilities but, today, much of the old style bell and spigot cast iron pipe has been replaced with "hubless" or "no-hub" cast iron pipe. Hubless pipe is connected with neoprene and stainless steel "no-hub" connectors.

SELECTING DRAINAGE PIPE AND FITTINGS



CAST-IRON AND THREADED STEEL PIPES

Cast-iron pipe has long been used for stacks, build and sewers, and any drains buried underground. It is in 2- and 4-in. sizes, in 5-ft. lengths either with end or with hubs at both ends (for making two short end pieces). Threaded, galvanized steel pipe - in 1-1/2- and 2-in. sizes in 21-ft. lengths - is generally used for branch drains and vent lines, and (sometimes) for secondary stacks. Steel pipe, however, is not used for drains buried underground.

So-called "sanitary" fittings must be used for sewer drainage lines. These come in both hub-type cast threaded iron (e.g. IOA). "Straight" (not sanitary) and "ordinary" (not sanitary) threaded fittings are used where gases only (no water) will pass through.

- | | |
|---------------------------------|--------------------------|
| 1 - Cast-iron pipe | 12 - 90° drain, ell |
| 2 - Threaded steel pipe | 13 - Toilet floor flange |
| 3 - Roof flashing | 14 - Toilet bend |
| 4 - San. lapped tee | 15 - Tapped toilet in |
| 5 - Threaded pipe nipple | 16 - Cleanout ferrule |
| 6 - San. tee with side tap (R) | 17 - San. 45° y |
| 7 - Straight tapped tee | 18 - Floor drain with |
| 8 - San. tee | 19 - San. 1/8 bend |
| 9 - San. tee with side tap (LH) | 20 - San. 1/4 bend |
| 10 - Drum trap | 21 - San. T-y |
| 11 - 90° drain, straight ell | 22 - Threaded |

The most common materials used in modern DWV systems are ABS plastic and copper. ABS pipe is restricted by Code to residential construction less than two stories in height, but is still the material of choice for most state park DWV system repairs. ABS is black in color, light-weight, easy to work, is resistant to chemicals and corrosion, and is economical. Fittings used with ABS pipe may be threaded or smooth. Terms such as hub, spigot, female pipe thread, and male pipe thread allude to the old cast iron and steel DWV nomenclature to describe modern ABS plastic fittings. A "hub" denotes a smooth bell, or "female" fitting which is designed to receive the end of a pipe or the smooth "spigot" end of another fitting. Hub and spigot ABS plastic fittings resemble the familiar PVC plastic "slip" fittings. ABS fittings are assembled and solvent welded like PVC but, when solvent welding ABS plastic, be sure to use ABS cement. PVC cement will not work with ABS pipe. As with other plastic pipe, threaded ABS fittings are sealed with thread sealing (TEFLON) tape.

The following pages are copied from a GSR company catalog to show some of the wide variety of ABS fittings available. Note the "part number" for each different item and size. Fittings manufactured by GSR have the part numbers cast into the side of each fitting to simplify identification. Compression fittings are available which will allow ABS pipe to be easily connected to cast iron, vitreous clay, and to other common DWV materials.



DRAIN-WASTE-VENT FITTINGS

For Non-Pressure Applications
Material: ABS-1 Black

Prices subject to change without notice. Customer is free to resell plastic fittings at any price he may choose. Possession of this price list shall not be construed as an offer to sell the products listed.

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR. CTN.
COUPLING	3000	1 1/4	.69	75
	3001	1 1/2	.51	60
	3002	2	.72	45
	3003	3	1.75	60
	3004	4	2.95	45
	↑3006	6	19.10	10

PIPE INCREASER—REDUCER				
	3022	1 1/2x2	1.66	50
	3023	1 1/2x3	3.41	20
	3029	1 1/2x4	7.58	15
	3024	2x3	3.41	35
	3025	2x4	6.65	10
	3026	3x4	5.90	10

FLUSH BUSHING				
	2750	1 1/2x1	.69	120
	2760	2x1 1/4	1.23	70
	2752	2x1 1/2	.54	65
	2762	3x1 1/2	2.86	30
	2754	3x2	1.89	40
	2758	4x2	7.07	20
	*2756	4x3	4.81	30
	↑2767	6x4	23.94	25

Spg x H				
	2751	1 1/2x1	2.26	120
	2761	2x1 1/4	3.53	60
	2753	2x1 1/2	2.26	65
	2763	3x1 1/2	6.04	25
	2755	3x2	8.05	40
	2759	4x2	11.56	20
**2757 4x3 12.77 15				
**EXTENDED STYLE				

MALE ADAPTER				
	2870	1 1/4	1.35	70
	2871	1 1/2	.83	50
	2872	2	1.40	40
	2873	3	3.23	30
	2874	4	8.97	10

FEMALE ADAPTER				
	2890	1 1/4	1.60	75
	2891	1 1/2	1.12	50
	2892	2	1.92	50
	2893	3	3.00	20
	2894	4	7.19	10
H x FPT	↑2896	6	24.50	10

FITTING C.O. ADAPTER				
	3700	1 1/4	1.63	100
	3701	1 1/2	1.03	65
	3702	2	1.55	35
	3703	3	2.63	25
	3704	4	6.47	10
	Spg x FPT	↑3706	6	18.73

CLEANOUT PLUG					
	3050	1 1/4	.86	200	
	3051	1 1/2	.77	120	
	3052	2	.86	80	
	3055	2 1/2	4.74	70	
	3053	3	1.48	30	
	3056	3 1/2	4.25	25	
	3054	4	2.86	30	
	MPT	↑3057	6	10.46	10

CAP				
	3081	1 1/2	1.84	90
	3082	2	2.97	50
	3083	3	5.24	75
	3084	4	7.06	40

CAP				
	3091	1 1/2	1.36	100

FPT				

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR. CTN.
1/16 BEND	2550	1 1/4	2.18	50
	2551	1 1/2	1.66	30
	2552	2	2.26	40
	2553	3	5.77	30
	2554	4	8.19	15
	↑2556	6	47.03	10

1/16 BEND, Street				
	2561	1 1/2	3.46	50
	2562	2	4.22	45
	2563	3	8.71	30
	2564	4	12.66	15
	↑2566	6	47.67	5

1/8 BEND				
	2500	1 1/4	1.30	50
	2501	1 1/2	.91	40
	2502	2	1.14	25
	2503	3	3.32	20
	2504	4	6.16	10
	↑2506	6	43.72	5

1/8 BEND, Street				
	2400	1 1/4	1.75	40
	2401	1 1/2	1.01	45
	2402	2	1.32	30
	2403	3	3.49	30
	2404	4	7.56	10
	↑2406	6	47.21	6

1/6 BEND				
	2600	1 1/4	3.10	50
	2601	1 1/2	1.92	40
	2602	2	2.75	20
	2603	3	8.05	30
	2604	4	13.25	10

VENT ELL				
	2200	1 1/4	1.80	50
	2201	1 1/2	1.40	40
	2202	2	1.83	30
	2203	3	5.30	20

VENT ELL				
	2203-1	3	7.76	30

1/4 BEND				
	2250	1 1/4	1.26	50
	2251	1 1/2	.91	75
	2252	2	1.23	25
	2253	3	3.95	30
	2254	4	7.25	10
	↑2256	6	47.74	5
	2221	2x1 1/2	4.33	30
	2223	4x3	7.99	25

1/4 BEND				
	2251-1	1 1/2	3.58	50
	2253-1	3	12.69	25

1/4 BEND, Street				
	2450	1 1/4	1.49	35
	2451	1 1/2	1.23	45
	2452	2	1.77	40
	2453	3	4.27	20
	2454	4	11.06	10

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR. CTN.
LONG SWEEP 1/4 BEND	2275	1 1/4	2.09	40
	2276	1 1/2	1.50	55
	2277	2	2.40	30
	2278	3	5.02	15
	2279	4	12.06	4

LONG SWEEP 1/4 BEND				
	2278-1	3	13.06	25

LONG SWEEP 1/4 BEND, Street				
	5278	3	8.93	20

1/4 BEND w/Side Inlet				
	↑2235	3x3x1 1/2	13.55	10
	↑2236	3x3x2	11.51	15

1/4 BEND w/Low Heel Inlet				
	2244	3x3x1 1/2	11.51	15
	2245	3x3x2	8.88	25
	2249	4x4x2	13.32	10

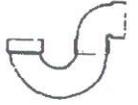
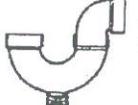
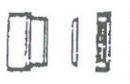
1/4 BEND, Street w/Low Heel Inlet				
	2248	3x3x2	13.06	15

WYE				
	2300	1 1/4	2.44	35
	2301	1 1/2	2.07	55
	2302	2	2.86	25
	2303	3	6.95	10
	2304	4	11.70	5
	↑2306	6	54.41	2
	2324	2x1 1/2 x 1 1/2	4.00	40
	2325	2x2x1 1/2	3.21	35
	2331	3x3x1 1/2	5.29	15
	2326	3x3x2	5.04	15
2328	4x4x2	8.49	10	
2327	4x4x3	10.25	10	
↑2344	6x6x4	54.49	5	

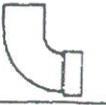
WYE				
	2301-3	1 1/2	6.02	

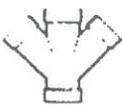
WYE, Street				
	5301	1 1/2	2.93	60
	5302	2	4.81	30
	5303	3	11.92	20
	5304	4	22.98	10
	5325	2x2x1 1/2	4.67	35
	5331	3x3x1 1/2	11.11	10
	5326	3x3x2	10.42	25
	5328	4x4x2	23.06	10
	5327	4x4x3	23.06	10

ABS-DWV

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR. CTN.
P TRAP LA PATTERN w/Union				
	3220A	1 1/4	6.44	20
	3221A	1 1/2	4.38	35
	3221B	1 1/4 x 1 1/2	5.10	35
	(WITH BRASS NUT & PLASTIC WASHER)			
	3221A3	1 1/2	8.62	15
P TRAP w/Union				
	3210E	1 1/4	6.21	60
	3211N	1 1/2	2.75	40
	3212E	2	7.74	20
P TRAP w/Union				
	3211F	1 1/2	8.71	30
	3212F	2	10.84	20
P TRAP w/Solvent Weld Joint				
	3200	1 1/4	5.68	35
	3201	1 1/2	2.84	40
	3202	2	5.05	20
	3203	3	18.81	10
	3204	4	33.15	6
P TRAP w/Cleanout & Solvent Weld Joint				
	3201A	1 1/2	5.44	35
	3202A	2	8.76	20
P TRAP U-Bend				
	3201-1	1 1/2	2.58	75
	3202-1	2	4.79	30
	3203-1	3	12.83	20
	3204-1	4	27.46	10
P TRAP Ell				
	2211	1 1/2 (Sht. Sweep)	2.50	150
	2212	2 (Sht. Sweep)	2.75	80
	3201-2	1 1/2 (Lg. Sweep)	1.19	150
	3202-2	2 (Lg. Sweep)	1.53	80
DRUM TRAP				
	3243A	3x6x1 1/2	14.93	4
TRAP ADAPTER, Female w/Washer & Nut				
	2850A	1 1/4	1.85	60
	2851A	1 1/2	1.28	75
	2852A	2	3.04	40
	2860A	1 1/2 x 1 1/4	1.46	50
	(WITH BRASS NUT & PLASTIC WASHER)			
	2851A3	1 1/2	4.94	50
	2860A3	1 1/2 x 1 1/4	5.10	60
H x Slip				
TRAP ADAPTER, Female Less Washer & Nut				
	2851	1 1/2	.84	75
	2860	1 1/2 x 1 1/4	.85	90
H x SJT				
TRAP ADAPTER, Male w/Washer & Nut				
	2800A	1 1/4	1.66	90
	2801A	1 1/2	1.35	50
	2802A	2	3.16	50
	2801A2	1 1/2 x 1 1/4	1.60	75
	(WITH BRASS NUT & PLASTIC WASHER)			
	2801A3	1 1/2	4.24	65
Spg x Slip				
TRAP ADAPTER, Male Less Washer & Nut				
	2801	1 1/2	.88	100
	2802	2	2.06	40
Spg x SJT				

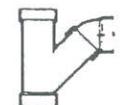
DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR. CTN.
P TRAP ADAPTER w/Washer & Nut				
	3211X	1 1/2	1.79	90
	3211Y	1 1/2 x 1 1/4	1.49	75
	(WITH BRASS NUT & PLASTIC WASHER)			
	3211X3	1 1/2	4.78	60
	3211Y3	1 1/2 x 1 1/4	4.40	65
Spg x Slip				
TRAY PLUG ADAPTER				
	3211-9	1 1/2	2.44	40
H x FPT				
TRAY PLUG ADAPTER				
	3211-7	1 1/2	1.95	40
	3210-7	1 1/4 x 1 1/2	2.01	60
Spg x FPT				
SWIVEL TRAY PLUG ADAPTER w/Washer				
	3217	1 1/2	1.75	80
	3218	1 1/4 x 1 1/2	2.01	70
H x FPT				
SWIVEL TRAY PLUG ADAPTER w/Washer				
	3215	1 1/2	1.72	70
	3214	1 1/4 x 1 1/2	1.79	50
Spg x FPT				
SWIVEL TRAY PLUG ADAPTER w/Washer				
	3216	1 1/2	1.92	55
Ext Spg x FPT				
SLIP JOINT NUT				
	3930	1 1/4	.46	250
	3931	1 1/2	.46	200
	3932	2	.86	150
	3933	1 1/2 x 1 1/4	57	200
CLOSET FLANGE, Hub End w/Gussets				
	3604	4	4.38	35
	3634	4x3	5.80	25
CLOSET FLANGE				
	3603	4 Hub	4.18	25
	3633	4x3 Hub	3.78	30
	3633-1	4x3 Spg	4.25	30
				
CLOSET FLANGE, Hub End, w/Adjustable Plastic Ring				
	3611 **	4	6.84	30
	3614 **	4x3	6.75	30
CLOSET FLANGE, Hub End, w/Adjustable Metal Ring				
	3611M **	4	10.53	30
	3614M **	4x3	6.62	30
CLOSET FLANGE, w/Adjustable Plastic Ring				
	3612 **	4	8.95	30
	3616 **	4x3	8.03	35
Spg				
CLOSET FLANGE, w/Adjustable Metal Ring				
	3612M **	4	9.68	30
	3616M **	4x3	8.67	35
Spg				

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR. CTN.
CLOSET FLANGE, w/Adjustable Plastic Ring Ext.				
	3613 **	4 (w/4" ext. spigot)	10.76	25
	3617 **	4x3 (w/3 1/2" ext. spigot)	10.26	25
Ext Spg				
CLOSET FLANGE, w/Adjustable Metal Ring Ext.				
	3613M **	4 (w/4" ext. spigot)	12.21	25
	3617M **	4x3 (w/3 1/2" ext. spigot)	11.22	25
Ext Spg				
CLOSET FLANGE, Reducing (2 1/2" Overall)				
	3634-7	4x3	4.86	20
Spg				
CLOSET FLANGE, Reducing (1 1/4" Overall)				
	3634-5	4x3	5.02	40
FPT				
CLOSET FLANGE, Reducing (2 1/4" Overall)				
	3634-6	4x3	4.86	30
FPT				
CLOSET FLANGE, Reducing (1 1/4" Overall)				
	3634-3	4x3	4.44	45
MPT				
CLOSET FLANGE, Reducing (2 1/4" Overall)				
	3634-4	4x3	4.05	25
MPT				
CLOSET FLANGE w/Adjustable Plastic Ring Reducing				
	3618 **	4x3	6.66	15
MPT				
CLOSET BEND, Reducing				
	3103	4x3	10.37	15
H x Spg				
CLOSET BEND, Reducing w/Test Cap				
	3103A	4x3	11.08	10
H x Spg				
EXPANSION JOINT				
	3811B	1 1/2	16.41	10
	3812B	2	14.17	15
	3813B	3	21.73	5
	3814B	4	33.13	4
	3816B	6	114.55	4
H x Spg				
SPIGOT ADAPTER, Clay Pipe (Adapts Clay Pipe Spigot to DWV Spigot)				
	3354	4	11.21	15
H x H				
NO-HUB ADAPTER, Cast Iron (Adapts No Hub Elastomer Coupling to DWV Spigot)				
	3422	2	2.89	20
	3423	3	3.95	20
	3424	4	7.33	15
	3421	2x1 1/2	2.52	50
	3428	4x3	8.11	15
H x Spg				

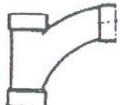
DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
DOUBLE WYE				
	2351	1½	5.30	40
	2352	2	6.07	20
	2353	3	15.69	10
	2354	4	31.84	5
	2374	2x2x 1½x1½	6.53	30
	2376	3x3x 1½x1½	11.08	20
	2377	3x3x2x2	14.09	20
	2380	4x4x2x2	20.99	5
	2381	4x4x3x3	26.20	6
	†2388	6x6x4x4	66.38	3

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
DOUBLE WYE, Street				
	5374	2x2x 1½x1½	10.44	30
	5377	3x3x2x2	17.94	15

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
COMBINATION WYE AND 1/8 BEND				
	2702	1¼	7.34	25
	2709	1½x1½ x1¼	8.39	50

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
COMBINATION WYE AND 1/8 BEND				
	2703-1	1½	8.53	45
	2704-1	2	10.49	20
	2710-1	3	20.77	15

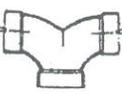
DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
UPRIGHT COMBINATION WYE AND 1/8 BEND				
	2732	2	9.74	30
	2733	3	21.53	15
	2741	2x2x1½	10.33	30
	2743	3x3x2	20.60	15

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
LONG TURN TEE WYE, SINGLE				
	4301	1½	3.30	50
	4302	2	3.98	25
	4303	3	9.45	10
	4304	4	19.10	5
	4317	2x1½x1½	5.02	40
	4318	2x1½x2	5.44	50
	4320	2x2x1½	5.21	20
	4326	3x3x1½	9.93	15
	4327	3x3x2	5.70	12
	4337	4x4x2	12.55	15
	4338	4x4x3	13.34	8

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
LONG TURN TEE WYE, DOUBLE				
	4401	1½	12.69	30
	4420	2x2x 1½x1½	13.33	25

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
DOUBLE FIXTURE FITTING				
	4153	2	9.67	20
	4155	3	20.62	10
	4149	2x1½x 1½x1½	8.65	20
	4151	2x1½x 1½x2	8.90	15
	4152	2x1½x2x2	8.65	20
	4154	3x2x3x3	20.45	10

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
DOUBLE FIXTURE FITTING, Street				
	5355	3	27.45	10
	5354	3x2x3x3	29.65	10
	5149	2x1½x 1½x1½	12.77	20

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
DOUBLE 1/4 BEND				
	2261	1½	4.35	70
	2262	2	6.60	35
	2263	3	14.37	10
	2264	4	24.06	10
	2265	2x1½x1½	5.56	50

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
VENT TEE				
	2100	1¼	2.84	30
	2101	1½	2.35	15
	2102	2	2.92	20
	2103	3	10.71	15
	2106	2x2x1½	4.81	65
	2104	3x3x1½	11.74	20
	2105	3x3x2	11.74	20

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
DOUBLE VENT TEE				
	2124	3x3x 1½x1½	17.38	15

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
FIXTURE TEE				
	4111	1½	3.57	35
	4127	2x1½x1½	5.84	30
	4130	2x2x1½	5.56	20

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
CLEANOUT TEE				
	2114	1½	4.18	15
	2115	2	5.35	30
	2116	3	8.07	20
	2117	4	14.72	12

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
SANITARY TEE				
	2150	1¼	1.75	25
	2151	1½	1.40	50
	2152	2	2.09	50
	2153	3	5.16	15
	2154	4	10.08	12
	2137	1½x1¼x1¼	2.98	25
	2125	1½x1¼x 1½	3.23	30
	2132	1½x1½x 1¼	2.61	35
	2128	2x1½x1½	1.86	35
	2127	2x1½x2	2.63	30
	2126	2x2x1½	1.86	30
	2131	3x3x1½	3.81	20
	2130	3x3x2	4.16	20
	2134	4x4x2	9.93	10
	2136	4x4x3	12.02	10

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
SANITARY TEE				
	2151-1	1½	5.67	50
	2153-1	3	11.91	15
	2182-1	3x3x2	11.25	35

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
SANITARY TEE				
	2152-2	2	6.95	35

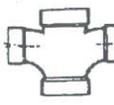
DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
SANITARY TEE				
	*2182	3x3x2	11.25	30

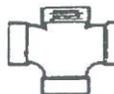
DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
SANITARY TEE, Street				
	5151	1½	2.26	50
	5152	2	3.78	40
	5153	3	8.93	15
	5154	4	20.99	10
	5128	2x1½x1½	3.61	50
	5127	2x1½x2	3.90	40
	5126	2x2x1½	3.58	50
	5131	3x3x1½	8.82	15
	5130	3x3x2	8.82	20
	5134	4x4x2	18.35	10

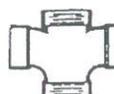
DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
SANITARY TEE, w/Right Side Inlet				
	†2145R	3x3x2x1½	23.66	20
	†2146R	3x3x2x2	19.53	20
	†2147R	3x3x3x1½	14.64	10
	†2148R	3x3x3x2	15.50	10
	†2157R	4x4x4x2	22.66	5

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
SANITARY TEE, w/Left Side Inlet				
	†2141L	1½	6.71	20
	†2142L	2	7.29	15
	†2145L	3x3x2x1½	21.76	15
	†2146L	3x3x2x2	19.53	20
	†2147L	3x3x3x1½	14.64	10
	†2148L	3x3x3x2	15.50	10
	†2157L	4x4x4x2	22.66	10

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
SANITARY TEE, w/Right & Left Side Inlets				
	†2146LR	3x3x2x2x2	23.90	20
	†2147LR	3x3x3x 1½x1½	18.04	10
	†2148LR	3x3x3x2x2	18.04	10
	†2157LR	4x4x4x2x2	25.69	5

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
DOUBLE SANITARY TEE				
	2187	1½	4.35	50
	2186	2	5.98	25
	2184	3	10.57	15
	2185	4	26.69	8
	2188	2x2x1½x 1½	5.02	20
	2189	3x3x1½x 1½	9.11	20
	2180-2	3x3x2x1½	9.83	25
	2181	3x3x2x2	8.42	20
	2190	4x4x2x2	25.26	15
	2191	4x4x3x3	25.26	10

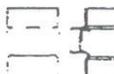
DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
DOUBLE SANITARY TEE				
	2180	3x3x2x1½	14.92	25
	2181-2	3x3x2x2	14.16	15

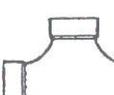
DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
DOUBLE SANITARY TEE				
	2180-1	3x3x2x1½	19.22	25
	2181-1	3x3x2x2	14.16	20

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
DOUBLE SANITARY TEE, Street				
	5189	3x3x 1½x1½	17.64	20
	5181	3x3x2x2	17.64	25

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
DOUBLE SANITARY TEE w/Side Inlet				
	†2163L	3x3x3x 3x1½	17.09	10
	†2164L	3x3x3x3x2	17.99	10
	†2160L	4x4x4x4x2	26.52	5

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
DOUBLE SANITARY TEE w/Right & Left Side Inlets				
	†2163LR	3x3x3x 3x1½x1½	20.99	10
	†2164LR	3x3x3x3x3x 2x2	20.45	10
	†2160LR	4x4x4x4x4x 2x2	31.44	5

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
HORIZONTAL TWIN TEE				
	3750	3x3x1½x 1½	19.51	20

DESCRIPTION	PART NO.	SIZE	PRICE EACH	MSTR CTN.
TWO-WAY CLEANOUT FITTING				
	†3723	3	15.20	10
	†3724	4	27.80	8

Raw sewage is a biological hazard, which may endanger the health of employees, the public, and the environment. Park maintenance workers must treat a sewage leak or spill as a serious event. For small spills, the typical treatment is to collect and return as much of the spilled material possible to the sewer system and then to disinfect the contaminated area. Hard (paved) surfaces are disinfected with a chlorine solution. Soft surfaces (dirt) are disinfected by spading agricultural lime into the contaminated soil. If a large spill occurs, notify your supervisor. Your supervisor will direct clean-up of the material in compliance with your district's emergency response plan.

In the event of any hazardous spill:

1. Avoid contact with the substance (stay upwind and uphill).
2. Secure the area to prevent others from contacting the substance.
3. Immediately notify your supervisor or a peace-officer of the incident.

39. It is unlawful for any person to dispose of _____ in any place or manner except by means of an approved plumbing and drainage system.
40. Every building in which plumbing fixtures are installed shall have a connection to a public or private _____.
41. _____ is a biological hazard, which may pose serious health risks to employees, the public, and the environment.
42. In the event of any hazardous spill avoid contact with the substance, stay _____ and _____.
43. In the event of any hazardous spill _____ the area to prevent others from contacting the substance.
44. In the event of any hazardous spill, immediately notify your _____ or _____ of the incident.
45. In the event of a raw sewage spill, hard (paved) surfaces are disinfected with a _____ solution.
46. Because of its shape and function the _____ is usually the first part of the DWV system to become clogged.
47. Chemical drain cleaner _____ be used unless all mechanical means have been attempted.
48. Drains can be cleared mechanically by using a plunger, snake, or hose. Caution must be taken if a hose is used to avoid sewage _____ - _____ into the fresh-water supply.
49. The large vertical drain-waste line in a building is called the _____ stack.

50. Drains and waste lines must be sloped to function properly. The required slope is _____ inch of fall for every foot of run (linear distance).
51. Vent lines must also be sloped to function properly. The required slope for vent lines is 1/4 inch of _____ for every foot of run.
52. ABS pipe can be connected to cast iron pipe with a _____ coupler.
53. GSR's part number for a 3 inch, female adapter is _____.
54. GSR's part number for a 2 inch, c.o. (clean out) adapter is _____.
55. GSR's part number for a 3 inch, 1/8 bend, street ell is _____.
56. GSR's part number for a 2 x 1-1/2 x 1-1/2 inch, wye is _____.
57. GSR's part number for a 3 inch, long turn tee wye is _____.
58. GSR's part number for a 2 x 2 x 1-1/2 inch, sanitary tee is _____.

FUEL SUPPLY (GAS) SYSTEM

The most common gaseous fuels are natural gas, propane, and butane. Most gases are odorless and must be treated with an odorizer to make them noticeable when a leak occurs. Propane and butane are liquefied petroleum (LP) gases. Of the two, propane is the more widely used fuel because it will gasify at lower temperatures. Propane has a heating value of over twice that of natural gas. Since liquefied petroleum vapors are heavier than air, no devices served by LPG may be located in an unvented pit or basement.

Materials used in gas systems are wrought iron or steel (galvanized or black), yellow brass or copper, approved PVC or PE. Valves manufactured for use in gas systems are stamped with the initials "AGA" on the valve body. Code states that no gas piping shall be installed in or on the ground under any building or structure, and that all gas piping in or under the building must be kept at least six (6) inches above grade. PVC and PE pipe may be used only for natural gas only in exterior buried locations. Copper pipe to be used with natural gas must be internally tinned to prevent internal corrosion by the gas itself. Steel pipe used underground must be protected from corrosion by approved "machine applied" protective coatings such as "Extru coat". Galvanized coating is not an approved protective coating. Underground steel pipe must have a minimum of twelve (12) inches of earth cover. Risers must be spirally wrapped with 10-mil ("pipe wrap") tape to a minimum 40-mil thickness from twelve (12) inches below the soil to six (6) inches above grade.

Materials used in gas systems are cut, threaded, and assembled in much the same way as are materials used in water systems. Coated steel pipe for underground must, however, have several inches of the coating removed from the end before threading. Since no portion of the pipe may be left uncoated, all fittings and removed or too damaged coating must be "wrapped" to a 40 mil thickness with "pipe wrap".

After a gas line has been assembled it must be tested. For most small systems, the Code requires that a gage is installed and the system is pressurized with air, CO-2, or nitrogen to a minimum of ten (10) p.s.i. of pressure for a minimum of fifteen (15) minutes. Because different materials and systems have different test requirements, it is always necessary to check the Code for each specific application. If the system loses pressure during the test, leaks in the piping must be located by applying soapy water to the exterior of the pipe. Flame, acid, or LPG **will not** be used to locate or repair leaks.

59. Liquefied petroleum vapors are _____ than air.
60. _____ gas pipe used underground must be protected from corrosion by approved "machine applied" protective coatings.
61. Galvanized coating is / is not an approved protective coating for underground gas pipe.
62. After a gas line has been assembled it must be _____.
63. Because different materials and systems have different test requirements, it is always necessary to check the _____ for each specific application.
64. Leaks in gas piping must be located by applying _____.

REPAIRS

Pipe Repairs

When a park maintenance worker is called on to repair a leaking pipe, it will most likely be outdoors or underground. Underground leaks may show up as moving water on the surface of the ground, as persistent damp spots, or areas with unusually green grass. Leaks can be hard to find. Water will often travel several feet before appearing on the surface. Some leaks may not show up on the surface at all. A professional leak detective with special equipment may be needed to locate hard to find leaks.

Repairing an underground leak is different than repairing a leak in a building. If a leak occurs in a building, the water is turned off immediately to minimize water damage. When an underground leak is detected, it's important to leave the water on whenever possible. Turning off the water will make it more difficult to pinpoint the exact location of the leak and may allow contamination to be drawn into the system.

When repairing an underground leak, the first thing that must be done is to determine how the water will be removed from the hole that you are about to create. If the surrounding area has enough slope, a trench may be dug downhill leading away from the leak. The area must slope enough to allow the trench to drain a work area that is at least six inches below the pipe to be repaired. If the work area is environmentally sensitive, contains cultural artifacts, or has insufficient slope for adequate drainage, a pump must be used. When a pump is used, a sump must be dug for the suction line. The sump must be deep enough to accommodate both the drafting screen on the suction line and provide six inches of dry working space below the pipe to be repaired.

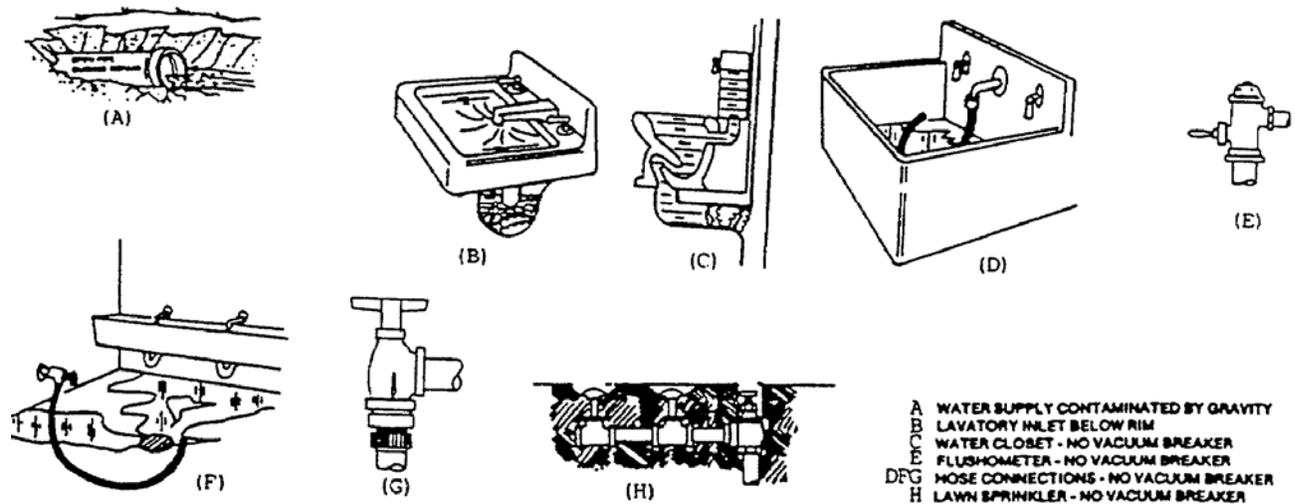
Make sure that the excavation is large enough to provide adequate working space to manipulate wrenches, etc., as well as to allow repairing the leak above any standing water. If the pipe is buried deeper than four (4) feet, shoring or benching must be provided for worker safety (Construction Safety Orders 1540-1541, provided in class).

After the leak is located and the damaged area of the pipe has been exposed, the water may be turned off and the leak repaired. If the pipe must be cut and a section replaced, the line must be sanitized according to American Waterworks Association Standard C601-81. Sanitation may be accomplished by slug chlorination, swabbing with hypochlorite solution or tablets, and flushing. A compression clamp can often be used to stop a leak without turning off the water. If a repair is made without turning off the water, sanitation is not required. A free chlorine test should be performed to ensure a residual is present in the system.

Maintenance workers must always be alert for any condition, which might allow pollutants to back-siphon into the water supply system. Besides damaged pipes, cross-connections may occur from conditions such as hoses and irrigation systems without backflow devices, and old style plumbing fixtures.

Cross Connections

High Risk Back-Siphonage (back-flow) Situations



65. When an underground leak is located, the water should be _____
_____ whenever possible to avoid _____ the system.
66. If an excavation is dug deeper than four (4) feet, _____ or benching must be provided for worker safety.
67. If a water supply pipe must be cut and a section replaced, the line must be _____ according to AWWA Standard C601-81.
68. Sanitation may be accomplished by slug _____, swabbing with hypochlorite solution or tablets, and flushing.
69. Hoses connected to sink faucets which might back-siphon pollutants into the water supply system are examples of _____.

Valves

Valves are the part of the plumbing systems that allow the user to control the flow of fluid or gas. Because the components of valves move, they are subject to mechanical abrasion and wear. Valves may leak externally or internally. An external leak commonly occurs when the packing around the stem wears down. An internal leak occurs when the valve gate, washer, or seat is worn away. External leaks, and some internal leaks (such as a dripping faucet), may be visibly detected. Internal leaks in main system shutoff valves cannot be visibly detected and usually go undiscovered until the water to the system must be shut off, but cannot be. Because water is abrasive, gate valves should never be operated partly open. The water will wear away the gate or seat if restricted. To replace valve stem packing, the packing nut must be removed.

The valve stem must be removed to replace the washer and/or valve seat. Lubricate valve and faucet stems with Non Petroleum grease.

Besides leaking, valves that are infrequently moved present an additional problem. The spaces around movable parts of the valve can become filled with minerals, rust, scale, and sand. If these materials are allowed to collect for long periods of time, the valve will become inoperable. To minimize this problem, a good maintenance program will include "exercising" the valves on system mains. Exercising a valve means to move the valve gate through its entire range, from the full open to full closed position, several times to dislodge any materials which may have collected in the mechanism.

70. A valve is used to _____ the flow of fluid or gas.
71. An external leak occurs when the _____ wears out around the stem.
72. Gate valves should never be operated _____ opened.
73. The spaces around movable parts of the valve can become filled with _____, _____, _____ and _____.
74. To replace valve stem packing, the _____ must be removed.
75. To replace a valve seat or seat washer, the _____ must be removed.
76. A good maintenance program will include " _____ ", _____, and _____ all main water shutoff valves.

Faucets

Faucets are simply valves used to control the flow of water in a sink, tub, or shower. There are two basic kinds of faucets, compression and washerless. A compression faucet uses a washer pressed against a valve seat to close. Repairs to compression faucets usually require replacement of deteriorated washers and/or seats. Valve seats can be replaced or dressed. Washerless faucets line up ports in the cartridge and body to allow water to flow. Washerless faucets usually require replacement of seals and springs, or replacement of a cartridge. Hot and cold water may be reversed if the cartridge is installed incorrectly. Repair parts for major brands of faucets are available in most building supply outlets. Be sure to have the manufacturer's name and model number available when shopping for parts. An aerator is placed in the tip of most faucet spouts. Particles can clog the screen in the aerator and restrict the flow.

77. A compression faucet closes by compressing a _____ against a valve seat.
78. A dripping faucet is usually the result of a deteriorated _____ or valve seat.
79. If a faucet continues to drip after the washer is replaced, dress or replace the _____.
80. When repairing a faucet, the threads of the faucet stem should be lubricated with _____.
81. Two basic types of faucets are _____ and _____.
82. If a faucet cartridge is incorrectly installed, the hot and cold water may be _____.
83. Almost every faucet has, at the tip of its spout, an _____. If this becomes clogged, water flow will be restricted.

Water Heater

A good maintenance program can prolong the life of a water heater. Checking the temperature and pressure valve, flushing and draining the tank every few months and visually inspecting are part of that program. A defective thermocouple or an extinguished pilot light may be the cause of no hot water from a gas water heater. A defective heating element or tripped breaker may be the cause of no hot water in an electric water heater. Basic instructions are printed on the jacket of the water heater.

84. Water heaters are equipped with drain valves. Good maintenance programs require the heater to be _____ every few months.
85. As part of the water heater maintenance procedure, the temperature and _____ valve should be tested.
86. A lack of hot water from a gas water heater may be caused by: a defective _____, or extinguished _____.
87. A lack of hot water from an electric water heater may be caused by: a tripped circuit breaker or defective _____ element.
88. Instructions for lighting a gas water heater pilot light are usually printed on the water heater _____.

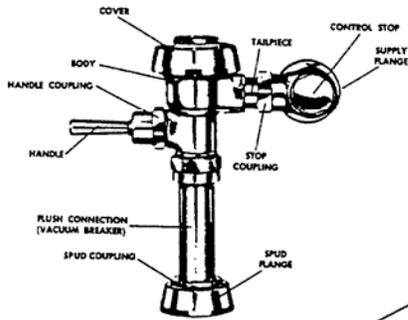
Toilets

To replace the wax gasket for a toilet with a wall mounted tank, the 90-degree supply pipe must be removed to allow the bowl to be lifted from the floor. Modern bowl mounted tank toilets do not, however, need to be disassembled to replace the wax gasket. If the tank is separated from the bowl, special care must be taken to avoid over tightening the mounting bolts and cracking the bottom of the tank. Additionally, the wax gasket with a plastic cone ("No Seep") may be used with most bottom discharging toilets on any floor surface and will greatly reduce the chance of future leaks. Wax gaskets are not recommended for wall-hung toilet bowls. Wall-hung toilets require a special gasket made of wax impregnated felt or synthetic foam. A tank toilet that runs continuously may have a problem with the ballcock or the float ball.

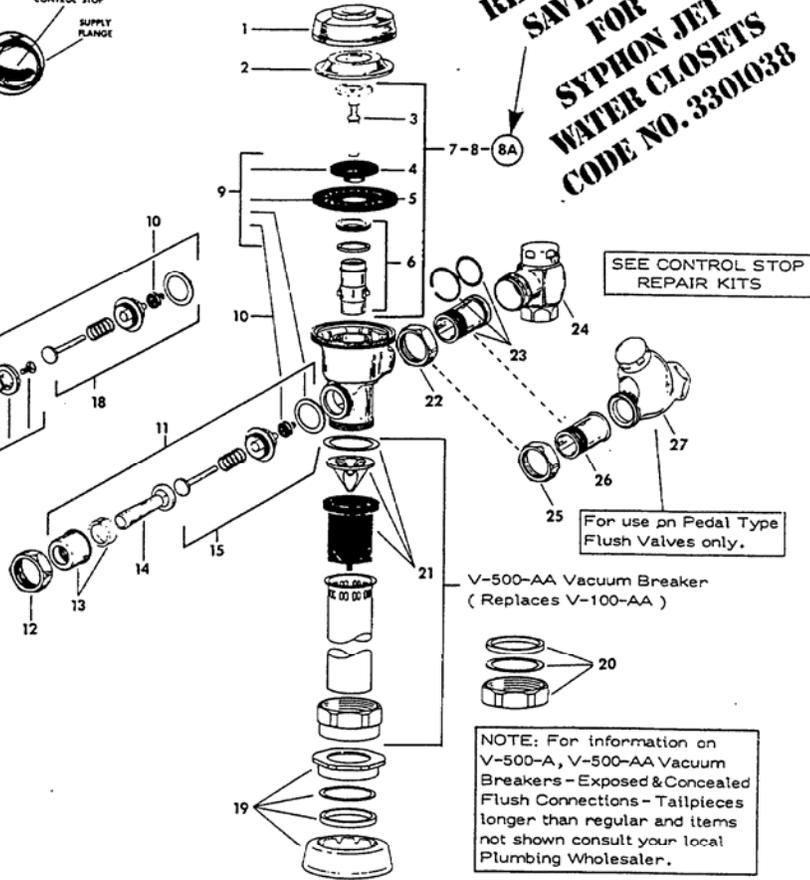
Tank toilets are used primarily in residential housing and facilities having low water pressure or volume. For high use public facilities, a tankless, pressure flush style toilet is preferred. The flushing action of pressure flush toilets is controlled by a flush valve, commonly called a flushometer. Flushometers provide quick recovery and good control of water consumption for facilities that serve large numbers of people. Flushometers have four basic components: a control stop to regulate the water entering the flush valve, a flush valve to control the length of flush, a handle assembly to activate the valve, and a vacuum breaker to prevent accidental contamination of the water supply system (cross connection).

A major manufacturer of flushometers is the Sloan Valve Company. Sloan manufactures several types of flush valves, including the very popular Royal and Crown models. The Royal and Crown valves employ operating principles that are typical of many major brands of flush valves. Royal flush valves use a diaphragm to regulate the flushing cycle, and Crown valves use a piston. Components and troubleshooting suggestions on the following pages are excerpts from the Sloan Repair Parts/Maintenance Guide. The guide, parts catalog, and repair parts price list are available free from the statewide contract vendor for Sloan parts.

**SLOAN RETRO (DIAPHRAGM TYPE) FLUSH VALVE
SINCE MID-YEAR 1971**



**NEW
RETRO WATER
SAVER KIT
FOR
SYPHON JET
WATER CLOSETS
CODE NO. 3301038**



The Repair Kits and Parts listed are designed to service All Sloan [Diaphragm Type] Exposed and Concealed Flush Valves. Each item has been identified by a Part Number along with a corresponding Code Number. To expedite your replacement requirements, order by Code Number.

PARTS LIST

- | | | | | | |
|-----|---------|---|-----|---------|---|
| 1. | 0301172 | * A-72 CP Cover | 19. | 0306125 | F-5-A 3/4" CP Spud Coupling Assem. |
| 2. | 0301168 | A-71 Inside Cover | | 0306132 | F-5-A 1" CP Spud Coupling Assem. |
| 3. | 3301058 | A-19-AC Relief Valve (Closet) - 12 per pkg. | | 0306140 | F-5-A 1-1/4" CP Spud Coupling Assem. |
| | 3301059 | A-19-AU Relief Valve (Urinal) - 12 per pkg. | | 0306146 | F-5-A 1-1/2" CP Spud Coupling Assem. |
| 4. | 3301111 | A-15-A Disc - 12 per pkg. | 20. | 0306052 | * F-2-A 3/4" CP Outlet Coupling Assem. |
| | 0301112 | A-15-A Disc (Hot Water) | | 0306077 | F-2-A 1" CP Outlet Coupling Assem. |
| 5. | 3301188 | A-156-A Diaphragm w/A-29 - 12 per pkg. | | 0306092 | * F-2-A 1-1/2" CP Outlet Coupling Assem. w/S- |
| | 0301190 | A-156-A Diaphragm (Hot Water) | | 0306060 | * F-2-A 1-1/4" CP Outlet Coupling Assem. |
| 6. | 3301236 | A-163-A Guide - 12 per pkg. | | 0306093 | * F-2-A 1-1/2" CP Outlet Coupling Assem. |
| 7. | 3301036 | Inside Parts Kit for Closets, Service Sinks, Blowout and Siphon Jet Urinals | 21. | 3323192 | V-500-A & V-500-AA Vacuum Breaker Repair Ki |
| 8. | 3301037 | Inside Parts Kit for Washdown Urinals | 22. | 0308676 | * H-550 CP Stop Coupling |
| 8A. | 3301038 | Retro Water Saver Kit-delivers 3-1/2 gal. | 23. | 0308801 | * H-551-A CP Adj. Tail 2-1/16" Long |
| 9. | 3301189 | A-156-AA Closet/Urinal Washer Set - 6 per pkg. | 24. | 0308757 | H-600-A 1" SD Bak-Chek CP Control Stop |
| 10. | 3302297 | B-39 Seal - 12 per pkg. | | 0308724 | H-600-A 3/4" SD Bak-Chek CP Control Stop |
| 11. | 3302279 | B-32-A CP Handle Assem. - 6 per pkg. | | 0308881 | * H-600-A 1" WH Bak-Chek CP Control Stop |
| 12. | 0301082 | * A-6 CP Handle Coupling | | 0308889 | * H-600-A 3/4" WH Bak-Chek CP Control Stop |
| 13. | 0302109 | B-7-A CP Socket | 25. | 0308063 | * H-6 CP Stop Coupling |
| 14. | 3302274 | B-32 CP Grip - 12 per pkg. | 26. | 0308026 | * H-5 CP Ground Joint Tail 1-3/4" Long |
| 15. | 3302305 | B-50-A Handle Repair Kit - 6 per pkg. | 27. | 0308884 | H-650-AG 1" SD Bak-Chek CP Control Stop |
| 16. | 0303351 | C-42-A 3" CP Push Button Assem. | | 0308882 | * H-650-AG 1" WH Bak-Chek CP Control Stop |
| 17. | 3303347 | 3" CP Push Button Replacement Kit | | | |
| 18. | 3303396 | C-64-A 3" Push Button Repair Kit | | | |

* Items also available in Rough Brass - Consult Local Plumbing Wholesaler for Code Number.

Troubleshooting and Maintaining the ROYAL Flush Valve

- 1 PROBLEM: Valve does not function.
CAUSE: Control stop or main valve is closed.
SOLUTION: Open control stop or main valve.
- 2 PROBLEM: Insufficient volume of water to adequately siphon fixture.
CAUSE: (a) Control stop not open enough.
(b) Urinal Valve parts installed in Closet Valve.
(c) Inadequate volume or pressure at supply.
SOLUTION: (a) Adjust control stop for desired delivery of water.
(b) Replace inside Urinal Valve parts with proper Closet Valve parts.
(c) If no gauges are available to properly measure supply pressure or volume of water at the Valve, then completely remove the entire Diaphragm Assembly (7-8) and open the control stop to allow water to pass through the empty valve. If the supply is adequate to siphon the fixture in this manner the Restriction Ring (A-32 on brass guides, A-164 on Cylolac guides) may be removed from the bottom of the guide to provide additional flow or a Sloan Guide Assembly (A-13-A Fullback) may be installed in the Valve. Should neither of these steps prove satisfactory, steps should be taken to increase the pressure and/or supply.
- 3 PROBLEM: Valve closes off immediately.
CAUSE: (a) Ruptured or damaged diaphragm.
(b) Enlarged by-pass orifice from corrosion or damage.
SOLUTION: Install Inside Parts Kit (3301036 or 3301037) to correct above problem and update Flush Valve.
- 4 PROBLEM: Length of flush too short (short flushing).
CAUSE: (a) Diaphragm assembly and Guide assembly are not hand-tight.
(b) Enlarged by-pass orifice from corrosion or damage.
(c) A-19-AU Urinal Relief Valve in Closet Flush Valve.
SOLUTION: (a) Screw the two assemblies hand-tight.
(b) Install Inside Parts Kit (3301036 or 3301037) to correct problem and update Flush Valve.
(c) Install Inside Parts Kit (3301036 or 3301037) to correct problem and update Flush Valve.
- 5 PROBLEM: Length of flush too long (long flushing) or failing to close off.
CAUSE: (a) Relief Valve (A-19-A) is not seating properly or by-pass orifice is clogged because of foreign material, or by-pass orifice is closed by an invisible gelatinous film from "overtreated" water.
(b) Line pressure has dropped and is not sufficient to force Relief Valve to seat.
(c) A-19-A Brass Relief Valve has been replaced by an A-19-A Delrin Relief Valve.
SOLUTION: (a) Disassemble the working parts and wash thoroughly.
NOTE: The size of the orifice in the by-pass is of the utmost importance for the proper metering of water into the upper chamber of the valve. DO NOT enlarge or damage this orifice.
(b) Shut off all control stops until pressure has been restored, then open them again.
(c) Install Inside Parts Kit (3301036 or 3301037) to correct problem and update Flush Valve.
- 6 PROBLEM: Water splashes out of fixture.
CAUSE: (a) Supply volume is more than is necessary.
(b) Lime accumulation on vortex or spreader holes.
SOLUTION: (a) Throttle down control stop.
(b) Remove the lime build-up.

- 7 **PROBLEM:** Flush is not considered "QUIET".
CAUSE: (a) Control stop may not be adjusted for quiet operation.
(b) Flush Valve is old model Valve which does not contain "QUIET" features.
(c) Fixture may be contributing noise.
(d) Conditions in piping system may be contributing noise.
SOLUTION: (a) Adjust the control stop for quiet operation while Valve is flushing, bearing in mind the fixture requirements for proper siphonage.
(b) Install Inside Parts Kit (3301036 or 3301037) and Control Stop Parts Kit.(see Control Stop Repair Kits for Identification).
(c) Determine that the noise is in the fixture by covering the fixture with a "quilt" or by placing cardboard under toilet seat, to separate bowl noise from Valve noise. If the fixture proves to be noisy, it should be replaced by a quiet-action fixture.
(d) A degree of high pressure in the piping system may be dealt with by adjustment of the control stop. Other noises which may be created by loose pipes, lack of air chambers, inadequate pipe sizes for pressure, etc., must be taken up with the building engineer.
- 8 **PROBLEM:** Chattering noise in Flush Valve.
CAUSE: (a) An A-56-A or A-156-A Segment Diaphragm has been installed in an old style valve which contained an A-26-A Rubber Diaphragm and a tight-fitting brass guide.
(b) The A-56-A or A-156-A Segment Diaphragm has been installed upside down.
(c) The Inside Cover has been distorted from freezing or abuse.
SOLUTION: (a) Remove the brass Guide Assembly and stroke each of the 4 wings of the guide with a file about six times, or install Inside Parts Kit (3301036 or 3301037).
(b) Replace the Segment Diaphragm to the proper position as instructed by markings on the diaphragm.
(c) This necessitates replacing Old Style Inside Cover with both New Style Inside and Outside Covers. (see Parts List).
- 9 **PROBLEM:** Leaking at Handle Assembly.
CAUSE: (a) Valve is old style and Handle Packing is worn.
(b) Handle Gasket has been omitted.
(c) The B-39 Seal may have deteriorated from exposure to heat before installation or from inactivity.
SOLUTION: (a) Install Sloan Handle Repair Kit (3302305).
(b) Install Sloan Handle Repair Kit (3302305).
(c) Install new B-39 Seal (3302297).
NOTE: The B-39 Seal will easily slide right onto the B-40 Bushing if it is wet.

CHROME DISCOLORATION:

Discoloring or spotting of chrome plated parts is a result of cleaning compounds containing muriatic acid which is found in commercial cleaning compounds. The presence of this acid (a minimum of 7%) removes the chrome and exposes the nickel.

A suggested recommendation for cleaning chrome plated parts is merely to clean them with soap and water and then rub dry with a dry towel or cloth. It is not necessary to use a commercial cleaning compound to clean or bring out the lustre of the chrome.

PROTECT AGAINST "FREEZE" DAMAGE:

If a building (e.g. stadium, beach house, etc.) is deactivated and such building is located in an area of the country subject to freezing temperatures, the procedure listed below should be followed to prevent "freeze" damage to the flush valves.

- 1 Shut off main supply valve and drain all water from the piping system.
- 2 Remove bonnet and inside parts from control stop of each flush valve to drain the water retained in the flush valve.

89. If a tank type toilet continuously runs water, the trouble is most likely associated with the _____ or _____.
90. Tank toilets are used primarily in residential housing and facilities having _____ water pressure or volume of use.
91. _____ provide quick recovery and good control of water consumption for facilities that serve large numbers of people.
92. If a Royal flush valve continues to run after the toilet is flushed, the first thing to check is the _____ in the diaphragm.
93. If water splashes out of the fixture when it is flushed, the control _____ may need to be adjusted.
94. Cleaning compounds containing _____ acid will remove the chrome finish on a flush valve and cause discoloration.
95. The manufacturer of Royal flush valves suggests the valve be cleaned with _____ and _____, then _____ dry.
96. Wax gaskets are not recommended for _____ - _____ toilet bowls.
97. If a toilet tank is separated from the bowl, over tightening the mounting bolts will result in _____ the bottom of the tank.
98. Water into the flushometer is controlled by the _____.

