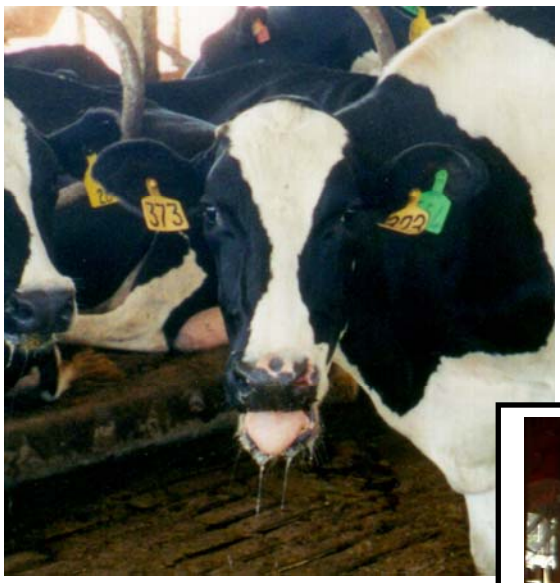


Heat Stress Relief For Dairy Cows

For additional information contact your local
Cargill Dairy Consultant

Jeffrey Brose, DVM
Dairy Specialist,
Cargill Dairy Enterprise, Cargill, inc.
Fort Collins, Colorado
Mobile 970-215-4513
Jeff_Brose@Cargill.com

Ver. 04-13

Dairy Cow Heat Production:

- Cows produce 4,500-6,000 BTU's per hour depending on milk production
- Heat production is similar to a 1,500 W hair dryer

Heat Stress consequences:

- Lower Production
- Rumen Acidosis
- Milk Fat Depression
- Poor Reproduction
- Laminitis/Lameness
- Lowered Immune System
- Mastitis
- Transition Disease (RP, DA, etc.)
- Low Body Condition Score
- Etc.....

Lactating Dairy Cow's optimal environmental temperature = 40-60º F
Heat Stress is a product of BOTH Temperature and Humidity
The THI threshold for reproduction is 65 which is lower than the THI of 72 for milk production.

Heat Stress Abatement:

- **Shade:**
- **Air:** Ventilation & Airflow: Open sidewalls, ridge, eaves, add circulation FANS!
  Fans start at 68º F, run continuously
  Provide 4-5 mph airspeed over cow beds and feed alley.
- **Sprinklers:**
  Evaporative cooling by wetting the skin with low pressure, large droplet water soakers
  - Feed line Sprinklers
    Sprinkler Nozzles deliver 0.5 - 1.0 gal./min. (.33 gal per cow per cycle)
    Begin; **>70º F = 1-3 min. ON every 15 min.**
    >80º F = 1-3 min. ON every 10 min.
    >90º F = 1-3 min. ON every 5 min.
  - Holding Pen Sprinklers
    Sprinkler Nozzles deliver 1 – 8 gal./min. (1 gal. per 150 ft^2)
    Begin; **>68º F = 1-3 min. ON every 6 min.**
- **Water** (drinking)**:** Intakes increase - up to 50-60 gal./cow/day
  2–3 ft. linear water space per 10 cows
  Minimum 2 waterers per group

Priorities for heat abatement:

- Holding Pen: fans & sprinklers
- Maternity Pen: fans & sprinklers
- Pre-Fresh cows: fans & sprinklers
- Lactating Cows:
  - Water over Feed lines
  - Fans over double Freestalls
  - Fans over Feed lines
  - Fans over single Freestalls
- Hospital Cows: fans & sprinklers
- Processing Areas: Head chutes, foot trimming, palpation rails, etc.
- Travel Lanes: Shade

HEAT STRESS ABATEMENT:

SHADE: Use solid shade or ≥90% shade cloth.

Open Lot & Pasture Shades:

Provide 40-45 ft^2 per cow, 20-32 ft. wide, 12-16 ft. height
North to South orientation,

Feed Lane Shades:

20-32 ft. wide, 12-16 ft. height
East to West orientation

Free-Stall Barn as shade:

4:12 roof pitch, Ridge opening 2"/10 ft. barn width, Eave opening 1"/10 ft.
12-16 ft. open sidewall height
East to West orientation

Holding Pens Shade:

Cover holding pen with solid shade, 4:12 roof pitch, Ridge opening 24"
12-16 ft. open sidewall height

AIR:

Maximize Ventilation (Air Exchange) & Airflow (Air Speed):

Open sidewalls, ridge, eaves, add circulation FANS!

FANS

- If you can't do BOTH fans & sprinklers, choose Sprinklers before Fans. Application of water with low pressure sprinklers cools cows more efficiently than fans alone. The use of water AND fans (5 mph air) is most effective.
- Fans start at 65-70º F, run continuously
- Provide 4-6 mph airspeed over cow beds and feed alley.
- Fan height <8', as low as possible but out of reach of cow & machinery
- **36" Fan spaced 20'-24' apart**
- **48" Fan spaced 24'-36' apart**
- Angle fan downward approx. 30° (aim toward floor at bottom of next fan)
- Fans should flow in direction of prevailing winds

Feed Lane Fans

800-900 cfm per headlock/feed space
36" fan every 20'-24' over cows backs when eating.

Freestalls Fans

800-900 cfm per stall
Double Row Freestalls: 48" fan every 24'-30' over center of stalls
Single Row Freestalls: 36" fan every 20'-24' over stalls

Holding Pens Fans

Provide approx. 1,000 cfm per cow
ex. One 36" fan per 10 cows or One fan per 150 ft^2
Mount Fans in rows with airflow toward back of holding pen.
36" fan every 20-24 ft.
48" fan every 24 -36 ft.
3 ft. between fans (ex. 36" fan mounted on 6' centers)
Fan height <8', as low as possible but out of reach of cow & machinery
Narrow holding pens (<24') can have fans along side of pen
Move air across and toward the back of the holding pen.
Take advantage of prevailing winds.

FAN CHARACTERISTICS

FAN TEST RESULTS –

Bioenvironmental and Structural Systems Laboratory
University of Illinois, Department of Agriculture & Biological Engineering
http://www.bess.uiuc.edu/
http://www.age.uiuc.edu/bee/research/handbook/handbook.html
36" Fan = 6,400-13,000 cfm range of airflows
48" Fan = 14,100-23,000 cfm range of airflows
Operational costs & efficiency varies widely across brands (8.3-18.6 cfm per watt)

Generally:

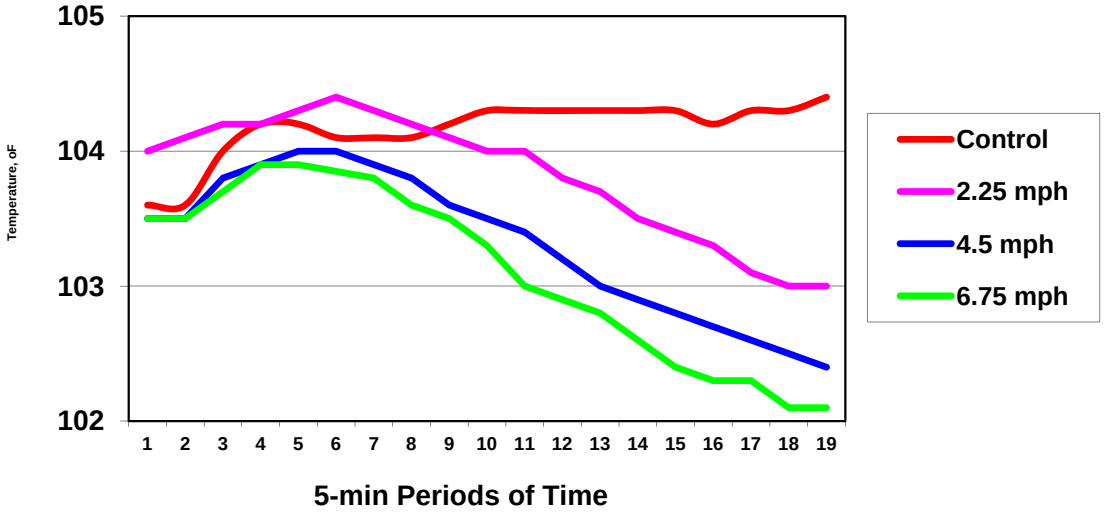
- For a given airflow, larger diameter fan is more energy efficient than several small diameter fans
- Two fans with equal diameter and rpm; fan with lowest motor currant rating is usually more efficient
- Two fans with equal airflow; fan with slower speed is usually quieter and more efficient
- Reasonable Fan Goals: 36" Fan = 11,000 cfm
  48" Fan = 20,000 cfm

Fan Maintenance:

Poor maintenance can reduce fan efficiency by >40%

Before each cooling season:
- Repair damage
- Check fan alignment & orientation
- Clean fan guards & blades
- Check and tighten belts
- Clean & calibrate thermostat

AIR SPEED



Cow cooling measured by vag. Temperature monitors at various airspeeds while using sprinklers every 10 minutes

Brouk, et al., 2004 ADSA

Optimum cooling is achieved with 4-6 mph continuous air speed combined with sprinklers.

WATER (drinking)**:**

- Water intake increases during heat stress (up to 50-60 gal./cow/day).
- Provide 2–3 ft. linear tank perimeter water space per 10-20 cows (3-4" per cow).
- Provide a minimum of 2 water locations per group.
- Provide water space at parlor exit alley, provide enough space for all cows to drink.
- Check flow rates during times of high water use.
- Keep waterers clean.

WATER SPRINKLERS - SOAKING:

- Sprinklers should wet the back and then stop to allow the water to evaporate prior to another cycle beginning. Evaporative cooling occurs by wetting the skin with low pressure large droplet water soakers.
- Sprinkler ON duration depends on nozzle water delivery rate.
- Sprinkler OFF duration (cycle) depends on temperature & humidity.
- Humid environments: set thermostat to begin sooner and use more frequent cycles.

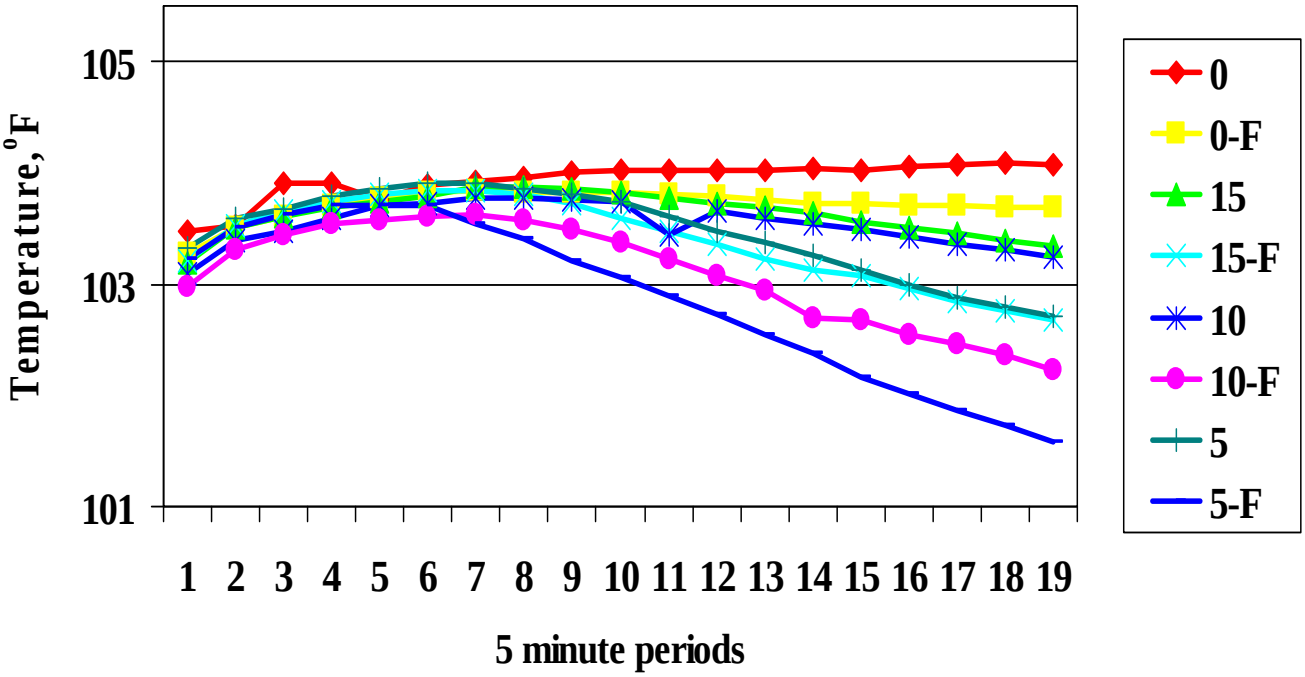
- ***Feed line Sprinklers:***
    - Sprinkler Nozzles deliver 0.5 - 1.0 gal./min. (.33 gal per cow per cycle)
    - Begin: **>70º F = 1-3 min. ON every 15 min.**
      >80º F = 1-3 min. ON every 10 min.
      >90º F = 1-3 min. ON every 5 min.
    - Application rate per cycle 0.04 inches/ft^2
    - Space Nozzles every 6 –8 feet.
    - Mounting: small diameter pipe (1") can be supported by tight cable; larger pipe (>1 ½") can be supported by angle iron.

- ***Holding Pen Sprinklers:***
    - Sprinkler Nozzles deliver 1 – 8 gal./min. (1 gal. per 150 ft^2)
    - Nozzles to deliver .03 gallons per ft^2 per min.
    - Begin: **>68º F = 1-3 min. ON every 5-6 min.**

- Check for adequate water source pipe size and flow. Solenoids, valves, etc. must also be adequately sized to prevent restriction.

- For maximum cooling, **FANS** should provide constant airflow of >4-6mph over the cows backs for optimal evaporative cooling.

Effect of Sprinkling Frequency and Fan Cooling on Body Temperature



Treatments

1. 0 - Control No Sprinkler or Fan
2. 0 + F - No Sprinkler + Fan
3. 5 - Sprinkler (1 min on & 4 min off)
4. 5 + F - Sprinkler (1 min on & 4 min off) + Fan
5. 10 - Sprinkler (1 min on and 9 min off)
6. 10 + F - Sprinkler (1 min on and 9 min off) + Fan
7. 15 - Sprinkler (1 min on and 14 min off)
8. 15 + F - Sprinkler (1 min on and 14 min off) + Fan

Sprinkler - .9 gal/min or .045 gal/ft^2 Fan – 650 to 700 CFM

KSU Cow Comfort Consortium 2001 (Brouk, M.J., J.F. Smith and J.P. Harner, III)

KSU Cow Comfort Consortium 2001 (Brouk, M.J., J.F. Smith and J.P. Harner, III)

If you can't install both fans & sprinklers, start with installing SPRINKLERS before FANS. Application of water with low pressure sprinklers cool cows more efficiently than fans alone.

• The use of FANS (5 mph air) AND WATER is most effective. •

SPRINKLER SYSTEMS for Feed Line Cooling

COW VIEW

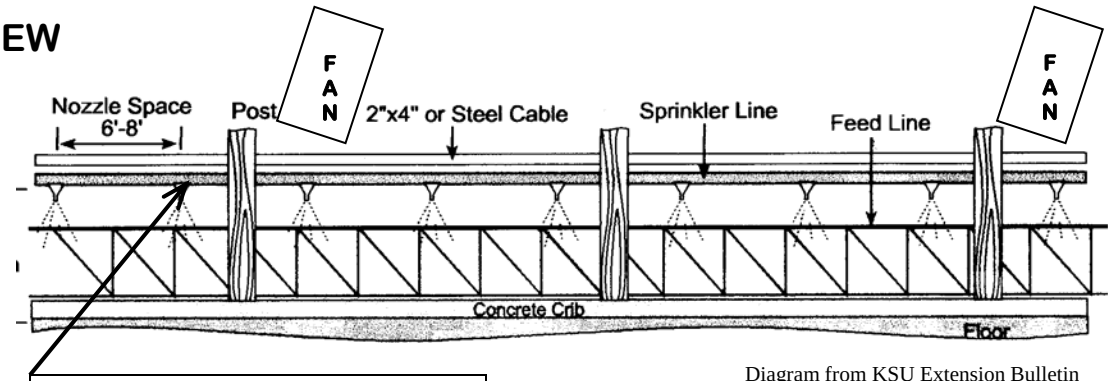


Diagram from KSU Extension Bulletin

Mount sprinkler:
1) 5-6 ft above floor (High Line)
2) Just above neckrail/headgate (Low Line)

TOP VIEW

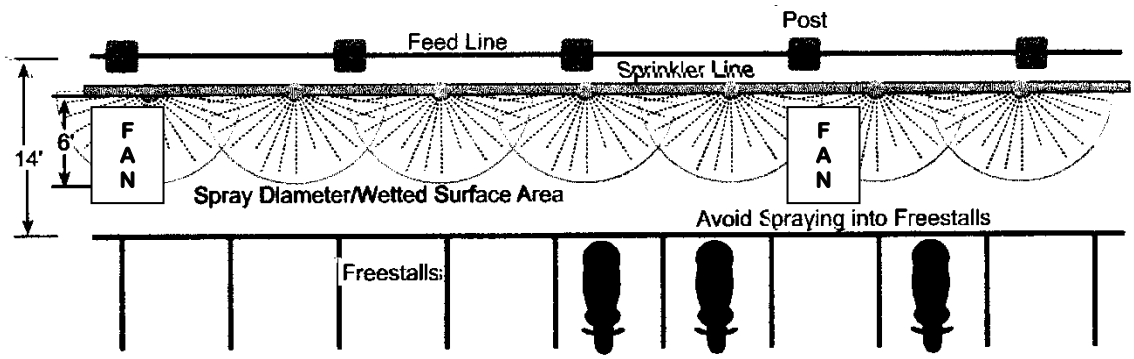


Diagram from KSU Extension Bulletin

Sprinklers should wet the back and then stop to allow the water to evaporate prior to another cycle beginning

SPRINKLER "SOAKER" SYSTEM COMPONENTS

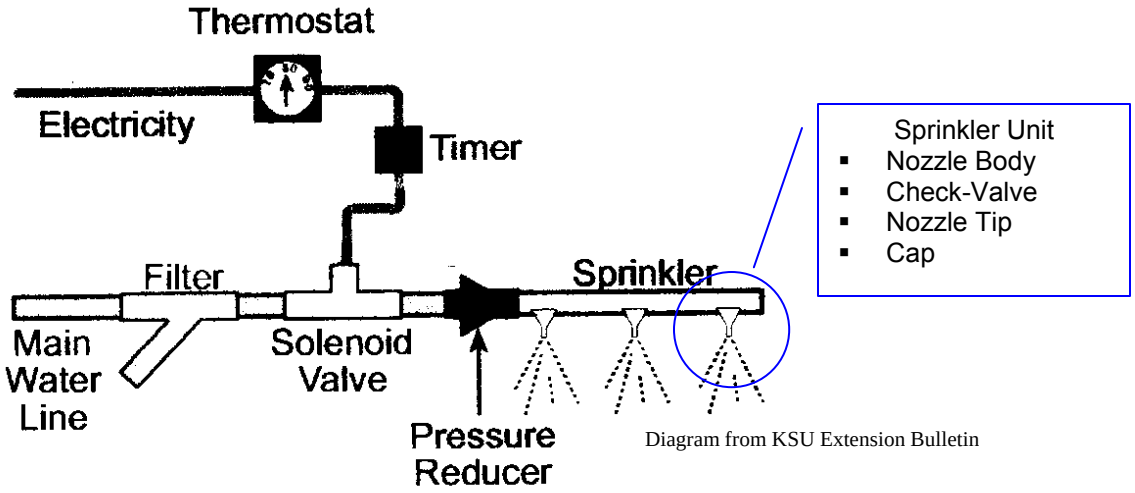


Diagram from KSU Extension Bulletin

Controllers (Timers/Thermostat)**:**

Adjust On/Off frequency or cycle
Thermostatically controls start of sprinkler system
Controls multiple "zones" (1-4 zones)
Controllers available that will reduce freq. of on/off cycle as temp. increases.

- Feed line Sprinklers
  Begin; **>70º F = 1-3 min. ON every 15 min.**
  >80º F = 1-3 min. ON every 10 min.
  >90º F = 1-3 min. ON every 5 min.
- Holding Pen Sprinklers
  Begin; **>68º F = 1-3 min. ON every 5-6 min.**

Preset Delay (Optional)**:**

Timer and preset delay for holding pens or freestall barns.
Allows you to turn water off while cows are away from freestall barn.
Automatically comes back on in a preset time. Up to 80 minutes.
Push delay switch, delays water-on cycle for 1 min to 80 minutes.
Dancon Products Model 191 - 120V.

Filter:

50 Micron Canister Filters, must meet required flow capacity

Electric Solenoid Valves:

Must match sprinkler pipe size, flow rate.
Would like solenoid to be "normally closed"
Need to know flow rate or gallons per minute needed thru solenoid
For example, calculate flow rate per minute on all nozzles in holding pen. No 13 Senninger nozzle is 3.75 gallons per minute times 16 nozzles = a demand of 60 gallons per minute through the solenoid and pressure reducer.
Need to know if timer control is 120V or 24V
24V solenoid with a 120V timer will require a relay or low volt reducer in the line between the timer and the solenoid

Pressure Reducer:

Low water pressure produces a larger water droplet size.

Adjustable pressure reducer, reduces line pressure to 15-20 psi

15 to 20 PSI – dependent on application in holding pen or freestall sprinklers

You can order based on "springs" in the brass pressure reducers.

6 to 10 springs for different PSI requirement.

Use a pressure reducer at 15-25 PSI for holding pen application

Use a pressure reducer or regulator at 15-20 PSI in freestall barn.

Nozzles & Tips:

Nozzle Tips to provide: Low pressure, large droplet size

Feedline Nozzles Tips:

Nozzle Tips to provide 0.5-1 gpm

Feedline Nozzle Body with checkvalve & cap:

Checkvalves in freestall barns are 10 psi.

IMPORTANT: *Checkvalves keep pipeline full between cycles.*

- 1) Nozzle Body: Clamp-On "saddle":
  - Clamps over pre-drilled 3/8" hole in S40 PVC Pipe
  - Available for ¾" or 1" S40 PVC pipe
  - Maximum length sprinkler line 180 ft. (1" pipe with 0.5 gpm nozzles)
- 2) Nozzle Body: Threaded, screw directly into ¼" pipe-thread tapped hole:
  - Drill & Tap 1/4" mpt (pipe thread) into S80 PVC or Steel Pipe
  - Use for low-line installation and large pipe sizes
  - Minimum pipe diameter 1.5"
  - Available in Brass: sturdy for low installation, more expensive
    - Ball & Spring check-valve/filter prone to lime build-up in hard water
  - Available in Plastic: cheaper
    - Diaphragm check-valve less problematic.
- Nozzle Cap:
  - 1) Threaded; requires wrench to clean nozzle, Cow safe
  - 2) Quick-Cap; No tools needed, Cows can lick off if low enough to reach

Holding Pen Nozzles:

- **Checkvalves** on nozzles in holding pen at 6 to 8 PSI.
- Approx. System capacity = 1 gallon per 150 ft^2 Pen.
- Mount nozzles 8-10 ft. above floor.

FEEDLINE SPRINKLER UNIT PARTS:

Nozzle Bodies

For feed lines less than 100 ft. length:

TeeJet Clamp-On Nozzle Body *with Check Valve*

Drill 3/8" hole in PVC pipe to attach sprinkler nozzle body.
Diaphragm Check Valve stops water flow at 10 psi so pipes stay full for next cycle. Uses Quick TeeJet Caps

- **QJ17560A-1-NYB** – for **1" PVC Pipe**

For feed lines greater than 100+ ft. length:

- TeeJet threaded Nozzle Body (screws into tapped hole):
  - Drill & tap ¼" npt threaded hole in 1½" or larger pipe (S80 PVC or galv. Steel).
  - Min. 1½" pipe diameter, S80 thick wall PVC pipe

  - PLASTIC (with side diaphragm check-valve):
    - **QJ8360-NYB** TeeJet Body **w/check-valve** ¼ npt
      - **Uses 25600-4-NYR**, TeeJet Quick-Cap, Plastic
    - **8360-NYB** TeeJet Body **w/check-valve** ¼ npt
      - **Uses CP8027-NYB**, TeeJet Screw Cap, Plastic

Nozzle Tips

TeeJet Nozzle Tips180° Spray pattern

Turbo FloodJet - Polymer Nozzle, large droplet size

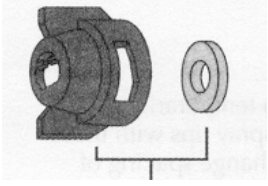
- **TF-VP5** – 0.7 gpm @ 20 psi (0.5 gpm @ 10 psi)
- Larger Flow Rate Nozzle:
  - **TF-VP7.5** – 1.1 gpm @ 20 psi (7.5 gpm @ 10 psi)

Caps

Quick TeeJet Caps w/ gasket (for attaching Nozzle Tips)

Secure nozzle tips to nozzle body without tools

- **25600-4-NYR Quick TeeJet Caps w/ gasket**



PVC Pipe Size:

Pipe Diameter (inches)	Feed line Length (feet) (maximum)	Max. Number Nozzles	Inlet Water Demand (gpm)
1.0 “	120	15	12
1.5”	240	30	22
2.0”	440	55	40
2.5”	700	88	62
3.0”	1000	125	88

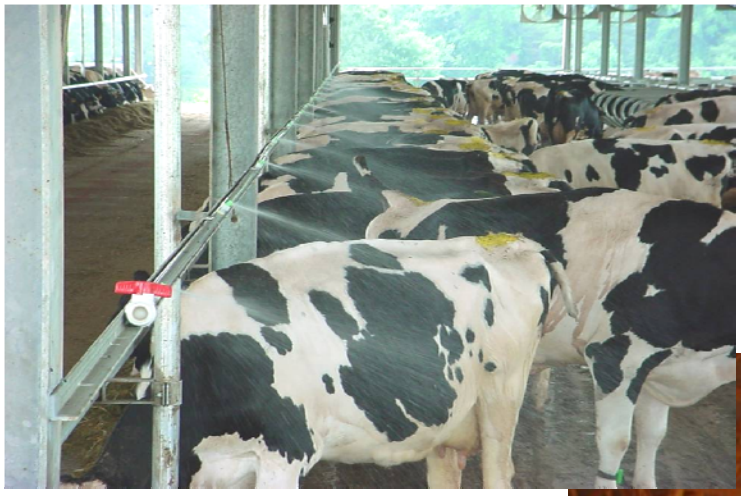
- 0.7 gpm TF-VP5 TeeJet FloodJet Nozzles, 8 ft. on center
- 20 psi water pressure

*You can’t overcome small pipe size with additional pressure

10% change in pressure only produces 5% change in flow (friction loss)

NOTES:

- Space Nozzles every 6 – 8 feet.
- Mounting Pipe
  - Small diameter pipe (1”) can be supported by tight cable
  - Large pipe can be supported by angle iron support.
- Provide drain valve at end of each line to prepare line for winter



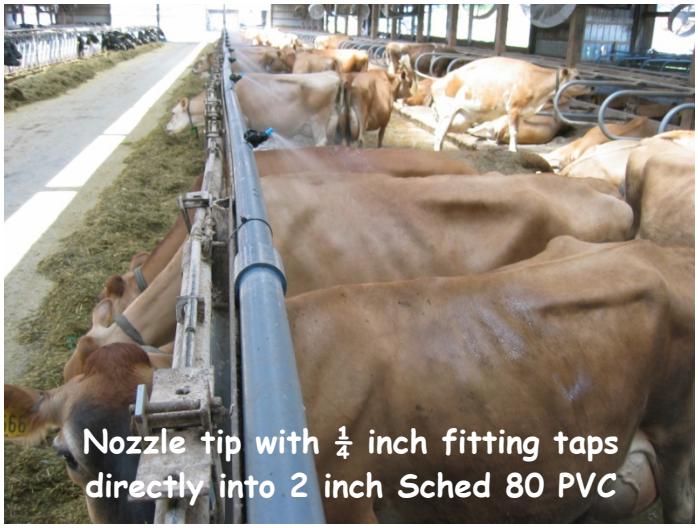
1 ½ " PVC with threaded TeeJet Nozzle body . Mounted to angle iron

1" PVC with clamp-on style TeeJet Nozzle Attached to tight ¼" cable

Feed-line Soaker Nozzles

Low mount Nozzle above manger rail or headlocks (within cows reach).

- Wither height (5'-6') for fast, thorough soaking.
- Less "drift" of water spray.
- Needs to be sturdy to prevent cow damage



High mount Nozzle, out of cows reach.

- Approx. 6-7 ft. height.
- More drift from wind possible.
- Use Quick-Caps for easy maintenance.
- Less vulnerable to cow & people damage.

Edstrom C-440S Controller


Edstrom High Capacity Kit
Filter/Solenoid/Pressure Reducer

INSTALLATION TIPS & IDEAS

Flex Hose

Use a flex hose or adjustable PVC union at water inlet so you can adjust angle of spray and reduce PVC breakage.

Drill Jig

Make a drill bit guide jig for drilling holes in pipe. Weld plate steel with appropriate size hole to angle iron to make jig. Place over pipe and angle iron to keeps holes aligned.

Tap threads. Use slightly undersized bit and only thread tap about half way for tight fit.

Use hose clamps to secure sprinkler pipe to angle iron support. Allows for spray angle adjustment

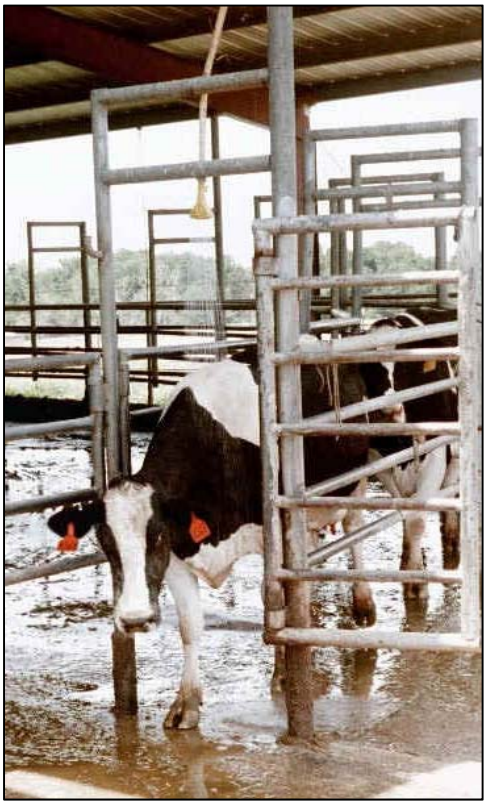
Parlor Exit Cooling

Exit Alley or Exit Platform Cooling:

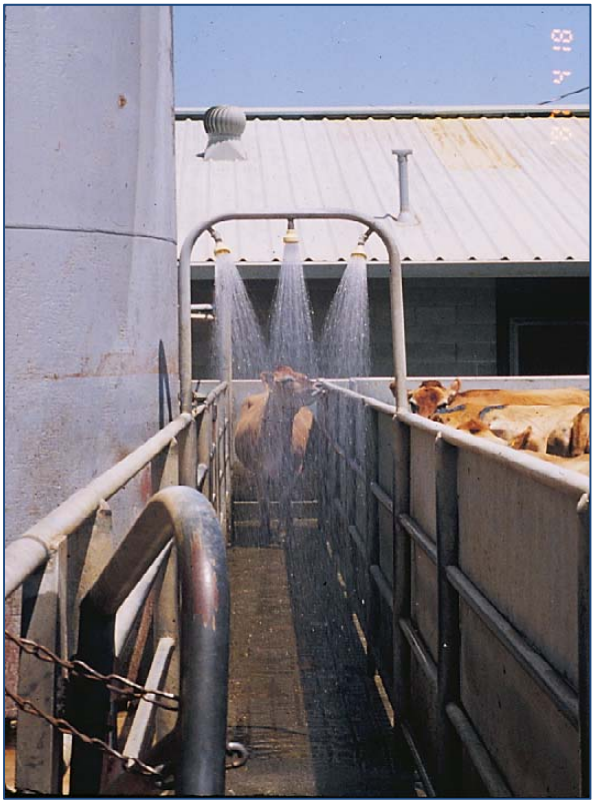
Thoroughly wet the cows after milking.
Cool cow for return trip to pen.

Considerations:

- Lower pressure so cows don't object to the spray and large water droplets that wet the cow to the skin.
- Showerheads and watering wand spray heads work well.
- A wand or an electronic eye can be used to turn on the water flow.
    - trigger a closed solenoid to open and release water for a set time.
        - Control spray time with a timer.
    - Trigger when the cows is under the shower, so they don't hesitate to enter the water stream.
    - An eye beam can get dirty quickly. Putting a fan on the electronic eye will provide enough turbulence to keep flies off the electronic eye, thus not triggering it unnecessarily and keep the device from becoming dirty with fly specks.
    - a quick solenoid valve is critical.
- Nozzles should be located about one foot behind the control switch, so that each cow is sprayed just after her head passes the spray area. This avoids water from being sprayed into the ear cavity. If sprayers are installed properly to hit directly over the topline of the cow, then water will not wet the udder and rinse off post-milking teat dip.
- Be sure you still have good cow flow out of the parlor and don't create a bottleneck.



Fan type watering head.
Simple and inexpensive.

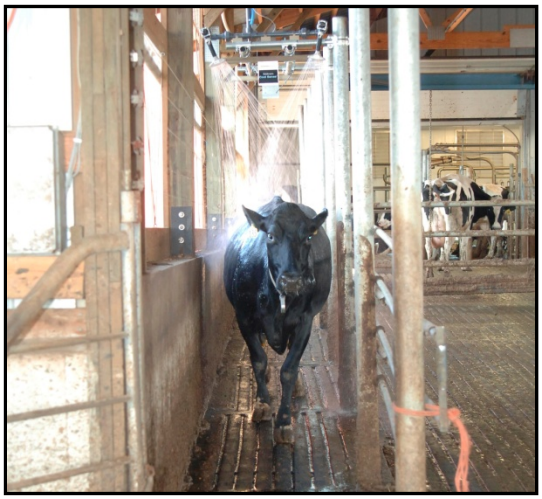


Large volume spray provides
good coverage

Parlor Exit Cooling

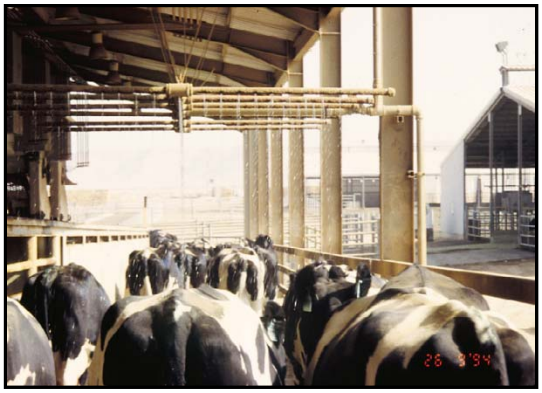
Edstrom Cool Sense®, Motion Cooling System

- The Edstrom Cool Sense automated cooling system for cows allows you to cool individual cows or groups of cows as they walk beneath the system through any type of alley, exit lane, doorway, sort gate or other common walkway. It is temperature activated, so it will only shower the cows when the temperature is above the user-defined set-point. It will also only shower for the length of time determined by the user. This prevents cows from stopping underneath the shower and wasting water. They must continue moving to keep the shower active beyond the preset shower time.
- By adding a second Manifold Kit, you can make a bidirectional system to shower cows travelling in both directions in the same alley. The sensors determine the direction of travel and initiate a shower from the appropriate set of nozzles.



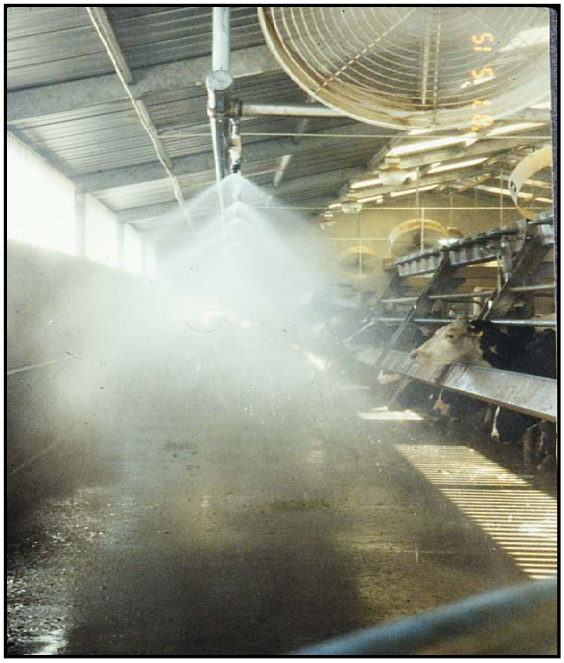
Edstrom Cool Sense®

Single alley spray



Wide exit alley coverage

Inexpensive Garden Hose Sprayers



Large nozzles on exit platform

Coverage on top and sides

Holding Pen Cooling

Research Studies on Heat Stress in Holding Pen

- Study 1: Body temperature decreased 3.5ºF and milk production increased 1.7 pounds per cow per day when cows were cooled
- Study 2: Milk production increased 5 lbs per day when cows were cooled for 30 minutes five times per day in the holding pen

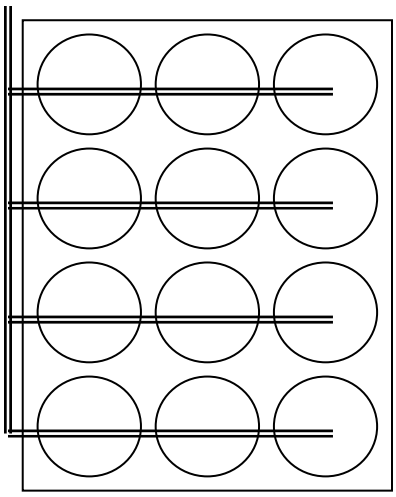
Reduce time in holding pen, improve ventilation, install fans, and install sprinkler system.

Holding Pen Sprinkler Systems:

Operate at 15-20 psi Pressure
Mount >8 ft. above floor
System capacity 1 gallon per 150 ft^2 (10 Cows)
Thermostat and timer: operation depends on nozzle size, temp. & humidity.
Locate thermostat in holding pen near cows
Cycle: 1-3 min. ON, 5-6 min. OFF
Sprinkle cows when temp. >70º F

1) Grid of sprinkler nozzles over holding pen

Senninger Irrigation inc.
www.senninger.com 407-293-5555
Senninger Super Spray sprinkler head
Use #6-12 nozzle with convex deep groove pad.
10-15 psi water pressure, 1.4+ gpm
Sprays 16-20 diameter 360º
Large main (≥1 ½") with ¾" - 1" PVC Pipe drop hoses
8-10 ft on center, 8-9 ft above floor



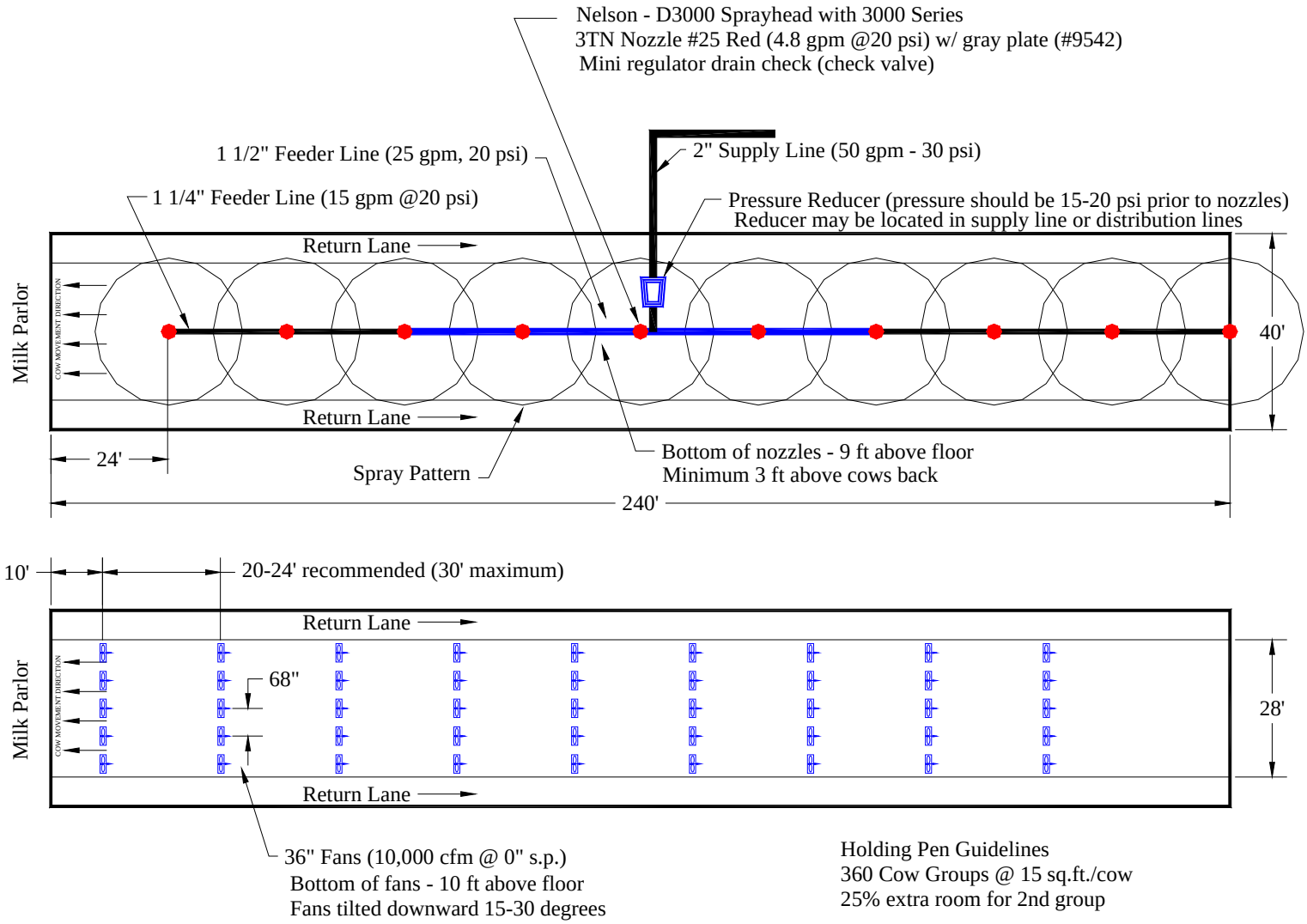
Senninger Super Spray #6 nozzle

Holding Pen Cooling (cont.)

2) Single row of high capacity sprinkler nozzles: Nelson – D3000 Sprayhead

with 3000 Series 3TN Nozzles #25 Red & #24 Gray plate (#9542)
4.8 gpm @20 psi
mini regulator drain check valve
install 24' on center, 9' above floor
360° - 28' diameter coverage (14' radius)

Nelson D3000 Spray head



Holding Pen Guidelines
360 Cow Groups @ 15 sq.ft./cow
25% extra room for 2nd group

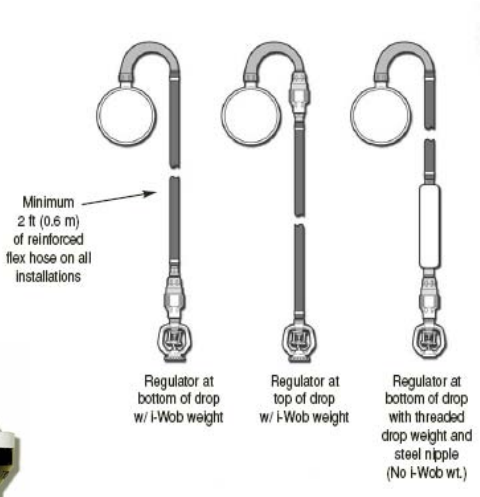
Harner, J.P., J.F. Smith , M.J. Brouk and J.P. Murphy. 2000. Reducing heat stress in the holding pen.. Cooperative Extension Service. Kansas State University. Manhattan, KS.

Holding Pen Cooling (cont.)

3) Single or double row of high capacity sprinkler nozzles: i-wob Nozzle by Senninger

I-WOB nozzles

#14 (blue) Nozzle, 10psi = 4.39 gpm
Approx. 49’ diameter, space: 20’ on center
Up to 60’ at higher pressure
Use with PR-10 HF Press Regulator



I-WOB nozzles

PR-10 HF high flow Pressure Regulator
Available in 10, 15, 20 psi operating pressure
10-32 gpm flow rate

i-mini wobbler nozzles

For holding pens <40’
#8 (dark lavender) Nozzle, 20psi = 1.95 gpm, approx. 35’ diameter
Space: 15’ on center
Use with Drain Stop Plus Check Valve

i-mini wobbler nozzles

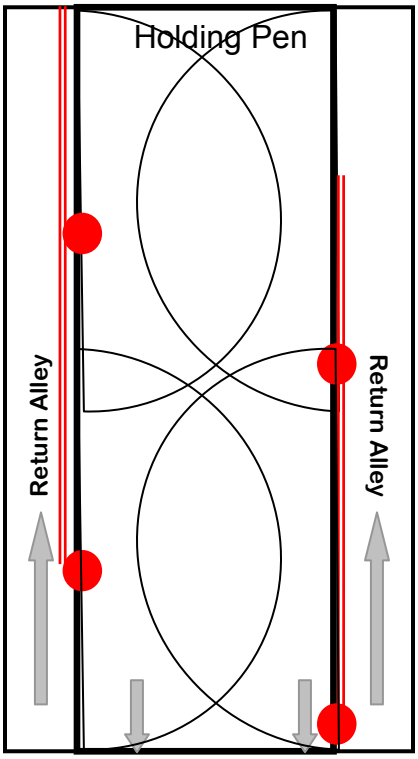
Drain Stop Plus DSP2M2F
Check valve

4) Row of high capacity sprinkler nozzles from each side of holding pen:

Rain Bird – Plastic Impact Sprinkler 2045-PJ low angle nozzle (LAN-1)

Rainbird Part# B46000-10-LA
2.20 gpm @ 25 psi,
22 ft. Radius, 23° trajectory angle
½" male NPT, Plastic
Spray from sides of holding pen
Install every 24' on centers, 6-7' above floor. Nozzles staggered on each side.

Rain Bird 2045-PJ low angle nozzle



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Jeffrey Brose DVM

Suppliers of Parts and Equipment

Timers, Controllers, Solenoids, Pressure Reducers, Tips and Nozzles

(This list is not intended to omit any dealers; it offers a list of Northeast U.S. suppliers for your convenience. Please let me know if you have equipment that should be considered.)

Timers / Controllers:

Edstrom Industries

Edstrom Industries 819 Bakke Ave., Waterford, WI 53185 800-558-5913
Larry DePriest (Northeast Regional Ag Manager)
larryd@edstrom.com Voice Mail 800-345-8074 ext. 369, Mobile 479-685-4843
www.agselect.com
Edstrom C-440S Controller, 4 zone controller, 2 stage temp. or Smart Mode
Edstrom C-110S Controller, 1 zone controller, 2 stage temp. or Smart Mode
Solenoid/Filter/Pressure Reducer Kits (¾" & High Capacity 1 ½") Need one kit for each feedline.
Low Capacity ¾" (18 gpm capacity) ID#7400-8945-160
High Capacity 1½" (20-30 gpm capacity) ID#7400-8940-100
Solenoids for Edstrom Controller (24 volt) ½" to 2 inch solenoids
1 ½" solenoid Part Number will be ID# 2010-8946-150
Dancon Timer and preset delay for holding pens or freestall barns.

Meter-Man

2 South Main, P.O. Box 746, Winnebago, MN 56098 1-800-338-5756 (Paul)
www.meter-man.com
EC120R0 3 stage temp., 3 zone controller compatible with low voltage solenoid
EC110R0 3 stage temp., 1 zone controller
Analog controller 1 zone controller

Manufacturers:

TeeJet Agricultural Spray Nozzles

www.teejet.com
Sprinkler Nozzles (Feedlines)

Nelson irrigation nozzles

www.nelsonirrigation.com
Sprinkler Nozzles (Holding Pens)

Senninger irrigation nozzles

www.senninger.com
Sprinkler Nozzles (Holding Pens), Small ¾ to 1.25 inch pressure regulators

Rain Bird Agri-Products Co. - irrigation nozzles

www.rainbird.com
Sprinkler Nozzles (Holding Pens)

Dancon Products

Model 191 - Preset timers, push-button Delay Switch, 80 minute range, 120V.
http://www.dancon.com/products/PresetTime/presettime4.htm
also available at **Edstrom** www.agselect.com

Sprinkler Nozzles, Solenoids, Irrigation Parts Distributors:

QC Supply :
Schuyler, NE 68661-0581
800-433-6340
http://www.qcsupply.com/
Edstrom Dealer (Controllers, Solenoid & Filter Kits)

Farmland Irrigation
3721 Arch Ave Grand Island, NE Keith Jardine
308-381-1509
i-wob & SuperSpray Senninger Irrigation Nozzle Dealer (holding pen sprinkler nozzles)

Fairbank Equipment
5018 South Antelope Dr Grand Island, NE 800-441-7550 or 308-381-4266
3700 Jewell St, PO Box 13237 Wichita KS 316-943-2247
www.fairbankequipment.com
TeeJet Dealer (feedline sprinkler nozzles)

Dave Reinecker Reinecker Ag Products
7270 Old Harrisburg Rd. York Springs, PA 17372
717-528-8428
daragprod@supernet.com
Edstrom Dealer (Controllers, Solenoid & Filter Kits)

Cedar Crest Equipment
Myerstown PA 717-866-1888 OR Quarryville, PA
717-806-0484
Edstrom Dealer (Controllers, Solenoid & Filter Kits)

Norbco, Inc. Mr. Paul Garrett
4754 State Rt 233 P.O. Box 370 Westmoreland, NY 13490
315-853-3936
Edstrom Dealer (Controllers, Solenoid & Filter Kits)

GVM, Inc.
74 Heidlersburg Rd., PO Box 358 Biglersville PA
800-345-3546 or 717-677-6197
www.gvminc.com
TeeJet Dealer (feedline sprinkler nozzles)

Paul B. Zimmerman
50 Woodcorner Road Lititz, PA 17543
717-738-7350
TeeJet Dealer (feedline sprinkler nozzles)

TRICKLE-EEZ, Co.
Biglerville, PA:
717-337-3030
Rain-Bird Irrigation Products (holding pen sprinkler nozzles)

L/B Water Service, Inc.
Chambersburg, PA 717-264-8445, Ephrata, PA Also Selinsgrove, Stoneboro, Ebensburg.
717-738-0389
www.lbh2o.com
PVC Pipe SCH-40 & SCH-80 all sizes, valves & fittings.

Watson Irrigation
4021 N. 6th Street, Harrisburg, PA 17110 800-999-1630 or 717-238-9730
www.watsonirrigationsupply.com
Nelson Irrigation Nozzles

Ag-Chem/AGCO Parts Distribution Center
300 Russel Drive, Middletown, PA 800-760-8800
TeeJet Dealer (feedline sprinkler nozzles)

Mid-Atlantic Irrigation Co., Inc.
1803 West 3rd Street, PO Box L Farmville, VA 23901 888-442-0240
http://www.irrigationparts.com/

Berry Hill Irrigation
Buffalo Jnt, Virginia (434) 374-5555 Contact: Durwood
http://www.berryhilldrip.com/Electric%20Valves.htm
1½" to 2" solenoids.

NetaFim
http://www.netafim-usa-landscape.com/Landscape/prod-valves-aquanet.php
1½" solenoid with a pressure regulator inside solenoids
Solenoids and pressure regulators from Nelson

Bermad
international company with dealers in Florida, Texas and California
Tom Gerardi 352-629-6838 or fax 352-629-3553 or mobile 352-895-1508
Manager, South East Region, Ocala, FL
Email: 428CJ@att.net
www.bermad.com/page.asp?product=34&pline=2
1, 1½, and 2" solenoid valve

www.irrigationtutorial.com/links/valvemanf.htm
large solenoid valves:

Berry Hill Irrigation
Contact Durwood
www.berryhilldrip.com/RegulatorPg.htm
Pressure regulators from Senninger

Grainger
http://www.grainger.com/Grainger/wwg/start.shtml

Schaben Industries
Columbus, NE 68601 Bakersfield, CA 1-800-274-1025 or 877-724-2236

NOTES: