"A Systematic Approach to Lens Verification for Ophthalmic Quality Assurance"

vision expo

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Disclosures

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- The content of this course was developed independently without commercial bias or influence
- Consulting
  - Essilor Instruments, USA
  - Visionix USA
  - Topcon Healthcare
  - Quest Vision Care Specialty Lab

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Trust But Verify

A Russian proverb:
A reminder to be vigilant and not blindly accept information, even when trust is present.

Think positive: trust that the lab has done it correctly but verify that they have.
We all make mistakes.

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Prerequisites for this presentation

An understanding of

- Spectacle prescriptions
- Lens designs
- Manual lensometry
  - Prism
  - Single vision
  - Bifocal/Trifocal
  - Variable power lenses
- ANSI Standards

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Learning Journey Objectives

- ❑ Choose your lab partner wisely
- ❑ Why Verification?
- ❑ Initial Visual Inspection
- ❑ Frame Information
- ❑ Verifying the Prescription
- ❑ Design/Material/Treatment
- ❑ ANSI standards
- ❑ Case Examples

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Choose Your Lab Partner Wisely

Key Criteria

- **Quality/Accuracy Standards**
  - Ask about error rates
  - Steps to minimize mistakes
- **Turnaround Time/Reliability**
  - Processing time
  - Relay communication
  - Rush services
- **Technical Capabilities/Equipment**
  - Modern surfacing/finishing equipment
  - Ability to do specialty work
- **Lens Material/Coating Options**
  - Stock or source
- **Customer Service/Communication**
  - Order status
  - Technical questions
- **Pricing Structure**
  - Compare to other lab pricing schedules
  - Multiple pair discounts
  - Total cost to include remakes, shipping
- **Reputation/References**
  - Ask around
  - Read reviews

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Importance of Lens Verification:

Protect the patient and your business

Catch the errors before they reach the patient

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Patient Safety & Quality of Vision

- Lenses match prescribed specifications
  - Eye strain, headaches, blurred/double vision
  - Trip/Fall prevention

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Professional Liability Protection

- Exposure to liability claims/malpractice
- Create documentation of quality control procedures
- Demonstrates practice of professional standard of care
- Regulatory compliance/ANSI Standards

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Cost & Efficiency

Prevent

- Patient complaints/returns
- Loss of appointment time

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Brand & Reputation Management

Consistent delivery of high quality products builds

- Trust
- Referrals

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First You Decide

Acceptable levels of quality/tolerance

Customer satisfaction/profit

Don't go crazy picking apart every detail
It's a waste of time and money

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Step by Step Verification

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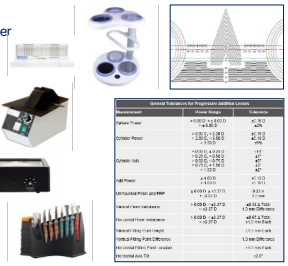
Equipment

- Lensmeter/Lens Analyzer
- Inspection station
- Lens Alignment Gauge
- Lens caliper
- Lens clock
- PD ruler
- Marking pen
- Ink pen/checklist
- Layout chart(s)
- ANSI Standards
- Adjusting tools
- Hot air blower/Salt pan



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Initial Visual Inspection

- Match the patient name on the lab order form to your spectacle order.
  - Multiple orders?
  - Match the frame with the frame information
- Visual inspection
  - Lens defects/properly mounted
  - Frame defects/alignment

Lab order Spectacle order

Laramy K Optical Verification

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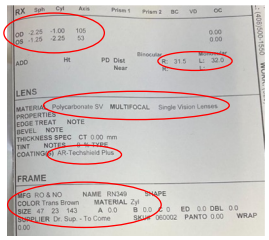
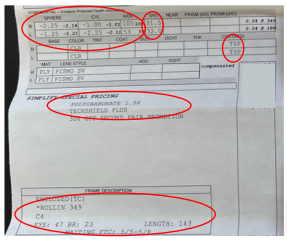
Verify the Written Parameters

Spectacle order



Lab order



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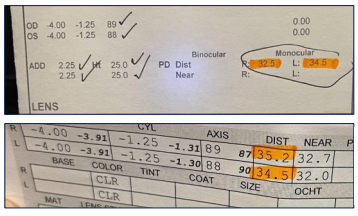
Case Example #1



Data entry error by optical staff member when inputting order on Eyefinity website.

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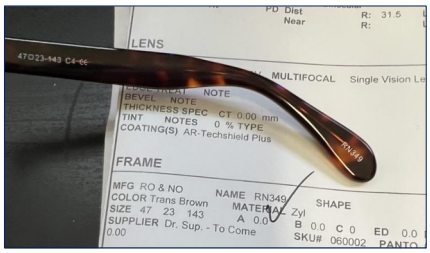
Verify the Frame



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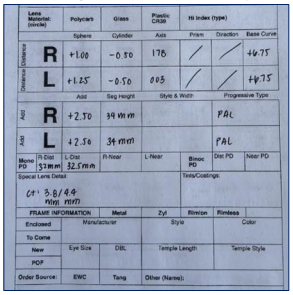
Verify the Prescription



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Manual Lensometry

IMO: Not as user friendly for verification

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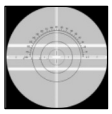
Manual Lensometer Calibration

- Adjust the height of the instrument
- Focus the eyepiece using a white background
- Set the reticule at a 180 degree orientation
- Set the power wheel on zero and the axis to 180 degrees
- Turn the instrument on
- Center the target using the compensating prism if it is off center
- Determine the sphere and cylinder lines
  (Sphere lines are perpendicular to the axis setting)

Wickedly Important!!!

Wickedly Important!!!



Caution: There are many different types of targets.
Never assume the sphere lines will always be the 3 thin lines

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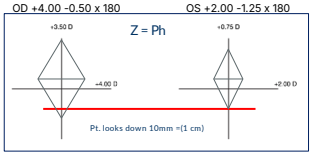
Determination Reference Lens

"Prism is relative to where the patient's eyes are."

The Reference lens = the lens with the most power in the vertical meridian

OD +4.00 -0.50 x 180 OS +2.00 -1.25 x 180



OD
Z = 3.50(1)
Z = 3.50pD BUp

OS
Z = 0.75(1)
Z = 0.75pD BUp

Net Prism
Z_{net} = 2.75pD BUp - OD

Visual inspection

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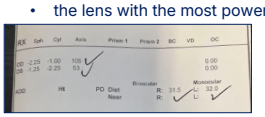
Prescription Verification

Start with the reference lens

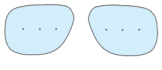
- the lens with the most power in the vertical meridian



Spherical equivalent:
OD -2.25 + -0.50 = -2.75
OS -1.25 + -1.12 = -2.37

Center the target in the reticle horizontally and vertically for the reference lens and dot.
DO NOT move the stage up/down between lenses.
This cancels out any vertical prism.

Dot the OCs
SV/BF/TF



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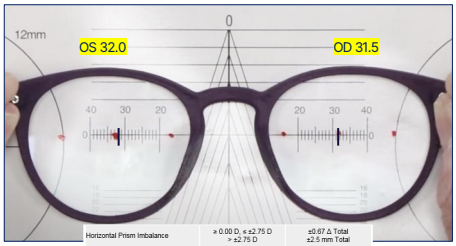
Verify IPD

Ordered



IPD = interpolar distance (dot on the front of the lens)
My tolerance is ±1.0 mm depending on the HZ power

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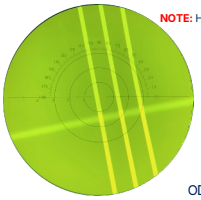
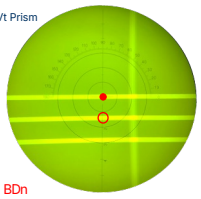
Verifying Prism

NOTE: Hz Prism is always recorded before Vt Prism





Rx Ordered
OD -1.75 -0.50 x 010 2.00 BI 1.25 BDn

Horizontal Prism
Orient reticule horizontally
Focus the vertical target line
2.00 BI

Vertical Prism
Orient reticule vertically
Focus the horizontal target line
1.25 BDn

Dot PRP and Verify IPD

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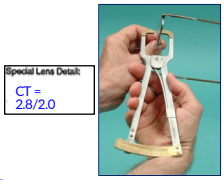
Thickness/Base Curves

- Stock finished lenses are already quality controlled
- Free form lenses: software program generates the best fit curves and optimal thickness
- Verify if you specified or they don't seem reasonable



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Multifocal Lens Verification

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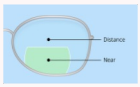
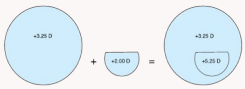
One Piece Multifocal vs. Fused Multifocal





Major Carrier Segment

- Add power created by increased the curvature in the segment.
- Segment can be on the **front** or **back** surface
- These can be **glass** or **plastic**

- Add power created by fusing higher index segment into the carrier of the lens
- Segment is located on the **front** surface.
- These are **glass** lenses

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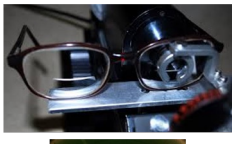
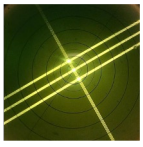
Measure the Distance Carrier Power

- Verify the Back Vertex Power (BVP) of the major carrier
- Follow the single vision lens verification procedure



Distance IPD

Dot the anterior poles of each lens.



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Methods for Measuring ADD Power

Approximate Method

Used for **minus lenses** or **carriers** with power **less than +3.00D** when the segment is on the front surface. Measure the back vertex power (BVP) in both the major carrier and the segment, then calculate the ADD power as the difference between these two readings.

Exact Method

Applied when the major **carrier** power **+3.25D and up** or **thickness (≥2.5mm)** with front surface segments. Measure the BVP in the major carrier, then measure the front vertex power (FVP) in both the major lens and segment. The ADD power equals the difference between the two FVP readings.

Lens Clock Method

Used specifically for **one-piece** multifocal lens designs. Measure the horizontal base curve in the major carrier using standard single vision procedures, then measure the horizontal curvature in the segment. The ADD power is determined by the difference between these two curvature readings.

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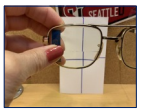
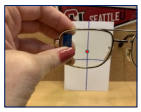
Near IPD





Use linear motion to locate the Seg. OC
Executive Bifocal IPD
Nasal edge is cut off on a FT

For visible segments
I use Binocular D/N IPDs & equal FVHs
unless there is a large asymmetry

Near IPD
59 mm

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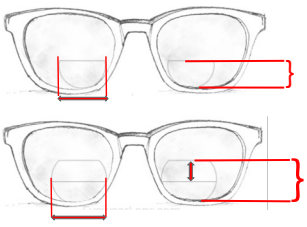
Multifocal Width & Vertical Fitting Height



VFH = Top of the segment to the lowest/deepest edge of the visible lens. (add 0.5 mm for bevel)

Segment width = widest part of the segment & Intermediate height
Ex: 8 x Executive or FT 7 x 28

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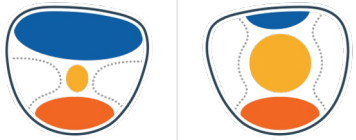
Variable Power Lens Verification



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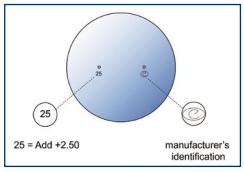
Lens Surface Permanent Markings



Manufacturer's ID marks are **34mm** a part
ADD power is on the **temporal** side
Lens **design** and **material** are on the **nasal** side

Laser engraved permanent markings are usually located in the **upper third** of the lens

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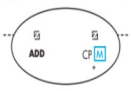
Lens Details

EPIC
ELECTRONIC PROGRESSIVE IDENTIFIER CATALOG

Surfacing
Drop: FC to PRP
Fitting Heights
Design

E ZEISS Choice Plus (13, 15, 17, 19, 21) — Carl Zeiss Vision



M Materials:
50 Plastic(CR39 and 1.50)
53 Trivex
59 Polycarbonate
60 Plastic High Index (1.60)
67 Plastic High Index (1.66-1.67)
* number here indicates design (13,15,17,19,21)

Standard Progressive
Fitting cross location: 6mm above 180 line
Rec. minimum fitting height: 13mm – 21 mm
Available as: Clear; Photochromic; Polarized
Available in: US and Canada
PAL Design on Back Side

http://epic.thevisioncouncil.org/

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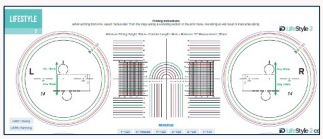
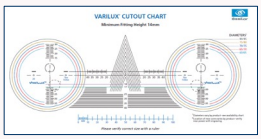
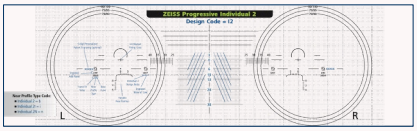
Centration Charts







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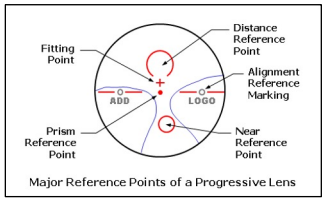
Non-permanent Markings

Non-permanent markings are in red.

Note: the PRP is always located midway between the manufacturer's reference markings (34mm a part)



Major Reference Points of a Progressive Lens

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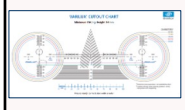
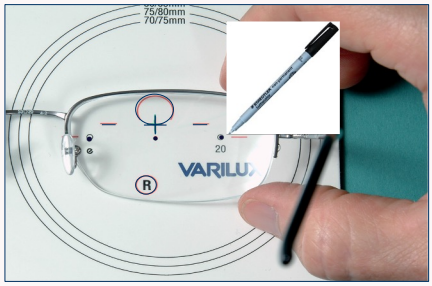
Non-permanent Markings

Use the designated cutout chart to draw on the non-permanent markings





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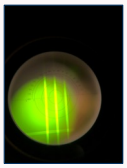
Verify the Sphere, Cyl, Axis



Use BVPto read the distance Rx (sph, cyl, axis) in the distance reference circle (DRC)

Note: The target may be off center. Do not center. Prism will be read at the PRP

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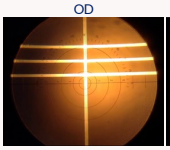
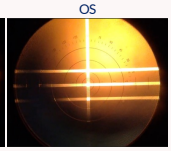
Verifying Prism at the PRP

OD



OS



OD 2.00 BU

OS zero

OD

OS

OD = 2.50 BDn
OS = 2.50 BDn
Net Prism = 0.00

Net prism:
2.00 BU OD

Equi thinning/prism thinning: reduces the thickness difference b/t top and bottom edges by grinding in base-down prism typically equivalent to about two-thirds of the lens's add power.

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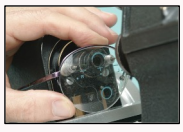
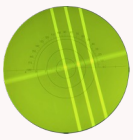
Verify the Engraved ADD Power

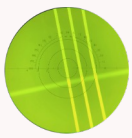
IF YOU REALLY MUST





Use most vertical lines for comparison.
Dist. Cyl. Line = -1.75

Compare Dist. BVP in DRC to Near BVP
ADD = Plano - (-1.75) = +1.75
(diff. b/t the 2 readings)



Near Cyl. Line = Plano

Note: the neutralized ADD power should be within 0.25D of the engraved Add power

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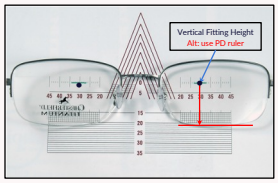
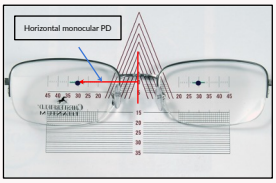
Horizontal and Vertical Fitting Measurements



Vertical Fitting Height (VFH) = measure from the center of the fitting cross to the lowest part of the visible lens
MPP: Use a PD Ruler



Distance Monocular PDs = measure from the center of the bridge to the center of the fitting cross
MPP: Use a Centration Chart

MPP = My Personal Preference

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Check the Alignment

Case Example #2
OD -2.00 -1.00 x 110
OS -0.50 DS
ADD +2.50

Easily fixed:
Remove lenses, reoriented, and reinserted

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Lens Analyzer

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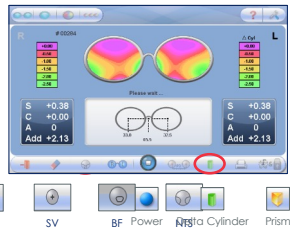
Measurement Modes

- Map Mode
  - Power
  - Delta Cyl
  - Prism
- Focal Type Mode
- Complete OD and OS Rx
- Binocular & monocular IPD



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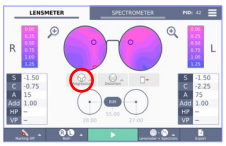
Measurement Modes

Map Mode

Focal Type Map



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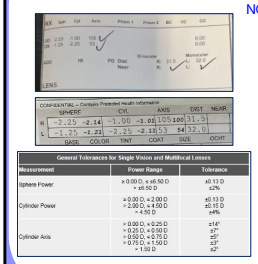
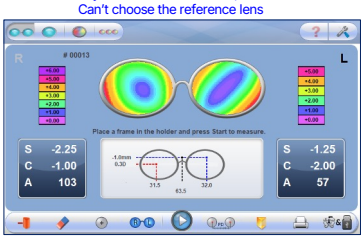
Lens Analyzer Verification

NOTE: VX40 always measures the OS first, Solos uses OD first
Can't choose the reference lens





When in doubt, double check using a manual lensmeter

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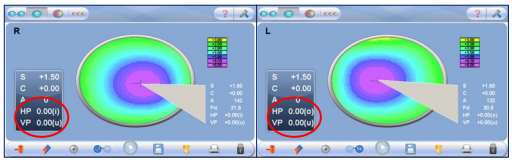
Lens Analyzer Prism Verification

Reference Point Analysis

- Place a reference point
- Shift between right and left lenses
- Compare the prism reading of the right and left lenses

	Sph	Cyl	Axis	Add	Prism	PD
R	+1.50	DS				31
L	+1.50	DS				31



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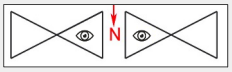
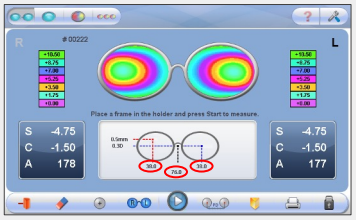
Horizontal Prism



Identifying Prism

- Prism map
- OCs displaced laterally
- Minus lens
- Pt. PDs are reference points

	Sph	Cyl	Axis	Add	Prism	PD
R	-4.75	-1.50	178		2.00 IN	34
L	-5.00	-1.50	177		2.00 IN	34



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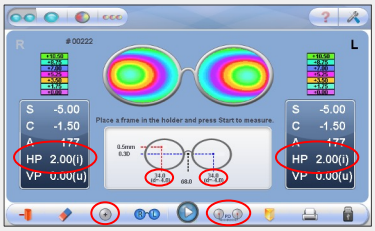
Horizontal Prism Verification

	Sph	Cyl	Axis	Add	Prism	PD
R	-4.75	-1.50	178		2.00 IN	34
L	-5.00	-1.50	177		2.00 IN	34

- Single Vision Mode
- Input prescribed PDs
- Instrument recalculates



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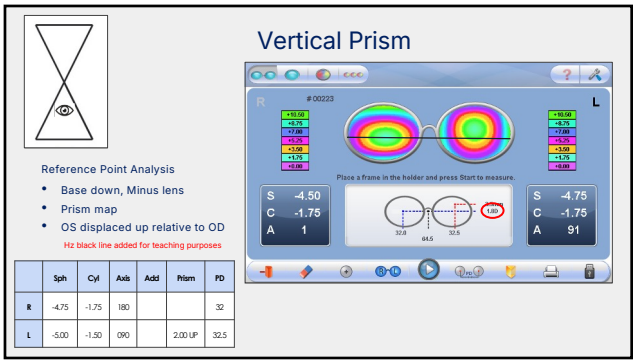
Vertical Prism
Reference Point Analysis
Base down, Minus lens
Prism map
OS displaced up relative to OD
Hz black line added for teaching purposes
Sph Cyl Axis Add Prism PD
R -4.75 -1.75 180 32
L -5.00 -1.50 090 2.00 UP 32.5

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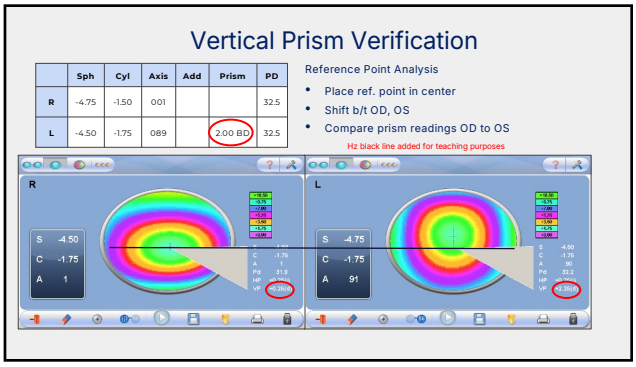
Vertical Prism Verification
Sph Cyl Axis Add Prism PD
R -4.75 -1.50 001 32.5
L -4.50 -1.75 089 2.00 BD 32.5
Reference Point Analysis
Place ref. point in center
Shift b/t OD, OS
Compare prism readings OD to OS
Hz black line added for teaching purposes

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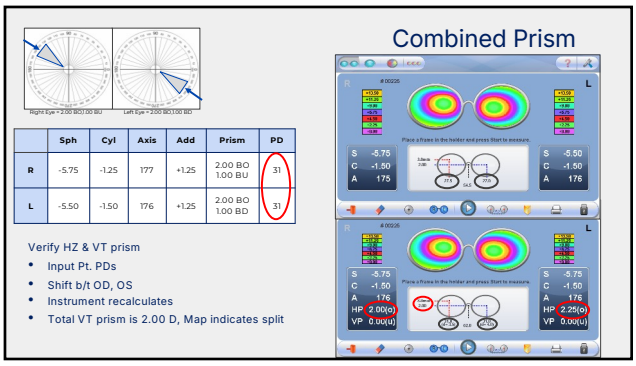
Combined Prism
Sph Cyl Axis Add Prism PD
R -5.75 -1.25 177 +1.25 2.00 BO 1.00 BU 31
L -5.50 -1.50 176 +1.25 2.00 BO 1.00 BD 31
Verify HZ & VT prism
Input Pt. PDs
Shift b/t OD, OS
Instrument recalculates
Total VT prism is 2.00 D, Map indicates split

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Verify Lens Treatments

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Final Lens and Frame Inspection

Look for:

- Lens imperfections (scratches/pits/warpage/specks)
- Coating imperfections (hazy,crazing, orange peel, bubbles, sag)
- Eye wire closure
- Edge bevel quality (chips, spaces, placement)
- Safety bevel
- Rolled/Polished edges

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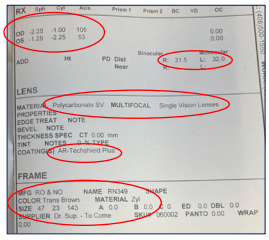
Verification Checklist

- Patient name/Job #
- Frame Info
- Focal Type
- Material
- Prescription
- IPDs
- VFHs
- Lens Treatments

Spectacle order



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ANSI Standards

General Tolerances for Single Vision and Multifocal Lenses		
Measurement	Power Range	Tolerance
Sphere Power	≥ 0.00 D, ≤ ±6.50 D > ±6.50 D	±0.13 D ±2%
Cylinder Power	≥ 0.00 D, ≤ 2.00 D > 2.00 D, ≤ 4.50 D > 4.50 D	±0.13 D ±0.15 D ±4%
Cylinder Axis	> 0.00 D, ≤ 0.25 D > 0.25 D, ≤ 0.50 D > 0.50 D, ≤ 0.75 D > 0.75 D, ≤ 1.50 D > 1.50 D	±14° ±7° ±5° ±3° ±2°
Add Power	≤ +4.00 D > +4.00 D	±0.12 D ±0.18 D
Unmounted Prism and PRP	≥ 0.00 D, ≤ ±3.37 D > ±3.37 D	0.33 Δ 1.0 mm
Vertical Prism Imbalance	≥ 0.00 D, ≤ ±3.37 D > ±3.37 D	±0.33 Δ Total ±1.0 mm Difference
Horizontal Prism Imbalance	≥ 0.00 D, ≤ ±2.75 D > ±2.75 D	±0.67 Δ Total ±2.5 mm Total
Vertical Segment Height		±1.0 mm Each
Vertical Segment Difference		1.0 mm Difference
Horizontal Segment Location		±2.5 mm Total
Horizontal Segment Tilt		±2.0°

General Tolerances for Single Vision and Multifocal Lenses		
Measurement	Power Range	Tolerance
Sphere Power	≥ 0.00 D, ≤ ±6.50 D > ±6.50 D	±0.13 D ±2%
Cylinder Power	≥ 0.00 D, ≤ 2.00 D > 2.00 D, ≤ 4.50 D > 4.50 D	±0.13 D ±0.15 D ±4%
Cylinder Axis	> 0.00 D, ≤ 0.25 D > 0.25 D, ≤ 0.50 D > 0.50 D, ≤ 0.75 D > 0.75 D, ≤ 1.50 D > 1.50 D	±14° ±7° ±5° ±3° ±2°

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Takeaway Message

- Choose you lab wisely
- Create/document a systematic approach to verification (staff training, liability)
- Have a solid knowledge of optics, never stop learning
- Keep up-to-date on the latest ophthalmic products
- Explore new instruments for better efficiency but keep the gold standards for back up
- Use ANSI standards as guidelines
- Trust but verify, let common sense and knowledge be your guide

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On behalf of Vision Expo, I sincerely thank you for being here this year.

Vision Expo Has Gone Green!

We have eliminated all paper session evaluation forms.
Please be sure to complete your electronic session evaluations online when you login to request your CE Letter for each course you attended!
Your feedback is important to us as our Education Planning Committee considers content and speakers for future meetings to provide you with the best education possible.

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